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An Annotated List of the Hemiptera (S.L.) of Alberta

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Despite the recognized economic importance of many members of the order Hemiptera the majority of species in this group are not of great interest either to the economic entomologist or to the general collector. For this reason relatively little is known about the distribution of many species throughout Canada. This lack of information is evident with regard to records of captures which have been made in Alberta. During the many years in which the Entomological Record was published, less than 80 entries referred to Albertan Hemiptera. Of these, only eleven concerned the suborder Homoptera. The order, as a whole, has fared hardly better in the Canadian Entomologist. Apart from a list by H. H. Knight[6], recording Anthochoridae and Miridae collected by J. H. McDunnough at Waterton and Nordegg, and three papers by the present writer discussing Fulgoridae[10] and Chermidae[11, 13] which are native to Alberta, there are only incidental references to the fact that other species of Hemiptera have been captured anywhere in this province.

A number of those which occur here, though they have never been so recorded in the literature, have been shown to be either of direct or indirect economic importance elsewhere. It appears, therefore, to be desirable that such data as are now available be brought together for publication.

In the University collection, with the addition of all records we have found in the literature, there appear to be approximately 560 authoritatively determined species and varieties native to this province. These are almost equally divided between the Heteroptera and the Homoptera. Of these, less than a third have been so recorded in American literature.

The following list, admittedly, must be a very incomplete representation of the total number of species which actually inhabit this province. It is hoped that its presentation will, at the least, serve as a contribution to a better knowledge of the distribution of members of this order in Canada while it may prove to be an incentive to more intensive collecting in it.

Acknowledgments and methods of recording captures

Species represented in the University collection are preceded by an asterisk. Each such name is followed by initials indicating the authorities who made the determinations for us. The initials so employed refer to the following collaborators to whom grateful acknowledgement is made for their invaluable assistance. (A.B.) A. R. Brooks; (B.B.) B.P. Beirne; (E.B.) E. D. Ball; (H.B.) H. G. Barber; (R.B.) R. H. Beamer; (C) J. S. Caldwell; (D.) C. J. Drake; (DeL.) D. M. DeLong; (G.) W. G. Gerhart; (H.B.H.) H. B. Hungerford; (H.M.H.) H. M. Harris; (K.) H. H. Knight; (P.M.) P. W. Mason; (Z.M.) Z. P. Metcalf; (McD.) J. H. McDunnough; (McG.) Mrs. McGillivray; (P.) H. M. Parshley; (E.S.) E. H. Strickland; (E.H.N.S.) E. H. N. Smith; (V.D.) E. P. VanDuzee; (W.) G. S. Walley.

Records not preceded by an asterisk but which are followed by the initials of a determinor refer to entries which have been generously supplied to us by

the Dominion Division of Entomology, while those of which we have literature records only are listed without further data than those of locality and months of capture.

In order to save space, locaties are given by a system of Arabic numerals. These conform with the ecological areas into which the province was divided, and which were mapped and described in some detail, by the writer in his list of the Diptera of Alberta[12]. These descriptions, together with the map, were reproduced by Bowman, in his list of the Lepidoptera taken in Alberta. A town, or feature, is selected in each of these relatively small areas. Since the surrounding country is moderately uniform, the numerical locality designations can, therefore, be interpreted as follows:—

1. *Cypress Hills;* An isolated plateau in S. E. Alberta, over 150 miles to the east of the Rocky Mountain foothills; partly treed, elevation up to 4,800 feet. Has never been glaciated.

2. *Medicine Hat,* 3. *Lethbridge;* Short-grass prairie; first area dry, second about 50% irrigated.

4. *Coronation,* 5. *Drumheller,* 6. *Calgary;* Short to long-grass prairie.

7. *Wainwright,* 8. *Red Deer;* Parkland, about 50% aspen groves.

9. *Saint Paul,* 10. *Edmonton*; Mixed aspen and spruce, about 75% cleared.

12. *Athabaska,* 15. *Beaverlodge;* Mixed northern forest and parkland.

16. *Edson,* 17. *Cochrane;* Foothill zones.

18. *Waterton,* 19. *Banff,* 20. *Nordegg,* 21. *Jasper*; Mountainous zones.

The months during which adults have been captured are designated by Roman numerals. Thus, the first record, "**Homaemus aeneifrons extensus* Why. (W.) = *aeneifrons* Say (G.) 1, 8, 10, 12, 17-20. VI-VIII" is interpretable as "Is represented in the University collection; so determined by G. S. Walley, also as *H. aeneifrons* Say by W. J. Gerhart; taken in the vicinity of Cypress Hills, Red Deer, Edmonton, Athabaska, Cochrane, Waterton, Banff and Nordegg from June to August."

With the exception of Miridae, Corixidae, Cicadellidae, Aphidae and Coccidae, all species are listed, in so far as this is applicable, in the order in which they appear in Van Duzee's 1916 list[14]. Despite the fact that revisions in certain groups have appeared subsequent to this publication, it still serves as the only comprehensive list for the entire order. Where modifications in generic concepts or in specific synonomy have gained general acceptance since the appearance of Van Duzee's list, the substituted names are employed. References to the authority for so doing are included in the bibliography.

Occasional notes on the habits of individual species refer to observations which have been made locally.

Suborder HETEROPTERA

Scutelleridae

*Homaemus aeneifrons extensus Wly. (W.) = aeneifrons Say (G.) 1, 8, 10, 12, 17-20. VI-VIII.
Feeds extensively on timothy grass flowers.

*Eurygaster alternatus Say (G.) 1-3, 6, 15, 17. VI-VIII.

*Fokkeria producta V.D. (E.H.N.S.) 2. III & VII.

*Phimodera torpida Wlk. (E.S.) 2. VIII.

* binotata Say (H.M.H.) 2, 3, 6, 10. V-VII.
Taken repeatedly from under stones.

Vanduzeeina borealis V.D. 18. VII.

Cydnidae.

*Galgupha atra A. & S. (H.M.H.) 2, 8, 10. VI-VII.
Taken on plantains and barley.
* nitiduloides Wolf. (E.S.) 3, 8, 10. VI-IX.
Taken on plantains.
*Corimelaena nigra Dall. (E.S.) = T. anthracinus Uhl. 10, 20. VIII.
* pulicaria Germ. (H.M.H.), (W.) 2, 3, 8, 9, 17. VI-VIII.
*Sehirus cinctus P.B. (H.M.H.), (W.) 3, 8, 10. V-VIII.
Nymphs and adults have been taken in large numbers on dandelions in alfalfa fields.

Pentatomidae.

Since these relatively large bugs are readily observed by the general collector it is probable that the following list is nearly complete for this province.

*Sciocoris microphthalmus Flor. (H.M.H.) 2, 17. VII.
*Brochymena quadripustulata Fab. (E.S.) 2. V & IX.
*Peribalus abbreviatus Uhl. (G.), (H.M.H.) 2, 3, 10, 15. V-VIII.
* limbolarius Stal. (G.) 3. V.
* tristis V.D. (H.M.H.) 2, 17. VII.
*Trichopepla atricornis Stal. (H.M.H.), (W.) 1, 3, 6, 18-20. VI-IX.
Taken on wild carrot.
*Rhytidolomia viridicata Wlk. (H.M.H.) 2, 3. IX.
* faceta Say (G.), (H.M.H.) 3. VIII.
*Chlorochroa uhleri Stal. (H.M.H.), (W.), (G.), (E.H.N.S.) 1-6, 8, 15, 18. I-XII.
A somewhat serious pest of wheat in certain years. It sucks the contents from developing grain.
(sayi Stal. 2-6. I-XII.)

This, undoubtedly, is the same species as that listed above as *uhleri*. Only one of these two species occurs here but it is recorded in economic literature as *sayi* with the statements that it first appeared in Alberta in about 1935 as a migrant from further south. Identical specimens are, however, present in a collection made by the writer at Lethbridge in 1913. In 1951, a specimen was submitted to us from the Yukon Territory and it was taken 100 miles N.W. of Whitehorse.

* ligata Say (H.M.H.) 2, 3, 19. VII.
*Carpocoris remotus Horv. (G.), (H.M.H.) 2-3. III-VII.
Feeds on wheat but is nowhere abundant.
*Euschistus euschistoides Voll. (H.M.H.) 2-3. VII.
Feeds on alfalfa.
*Coenus delius Say (H.M.H.), (W.) 2, 3, 10, 18. VI-VIII.
*Aelia americana Dall. (H.M.H.) 2, 3, 8, 10, 15, 17. V-VII.
*Neottiglossa undata Say (H.M.H.) 1, 2, 6, 8, 15, 18. VI.
* trilineata Kby. (G.) 12. VIII.
*Cosmopepla bimaculata Thom. (H.M.H.), (W.) 3, 8, 10. VI-VII.
A rather general feeder, breeds abundantly on fireweed (*E. angustifolium*) at Edmonton. The adults often annoy housewives by congregating on laundry.
*Thyanta rugulosa Say (G.) 5, 17. VII-VIII.
Taken most frequently on wild gooseberries.

*Banasa dimidiata Say (G.), (H.M.H.) 1, 3, 5, 8, 18. V-VII.
*Meadorus lateralis Say (G.), (H.M.H.) 3, 10, 15. VIII.
*Elasmostethus cruciatus Say (H.M.H.), (W.) 8, 10, 15, 17. VI-VIII.
*Perillus bioculatus Fab. (H.M.H.), (W.) 2, 3, 12. VII-IX.

Feeds rather freely on the larvae of *Lina scripta* in addition to those of *Leptinotarsa decemlineata.*

* clanda Say (H.M.H.) 2, 3, 5, 8. VII-IX.
* exaptus Say (G.), (H.M.H.) 1-3, 8, 10. V-VII.

Rhacognathus americanus Stal. 19.
*Apateticus bracteatus Fit. (G.), (H.M.H.) = crocatus Uhl. (W.) 1-3. VIII.

Predatory of Lepidopterous larvae and adults, capturing the latter when they visit flowers.

Podisus maculiventris Say (W.) 3. V.
* modestus Dall. (G.), (H.M.H.) 2, 8, 10, 12. V-VIII.
* placidus Uhl. (E.S.) 3, 17. VI.

Predatory on tent caterpillars (*Malacosoma* spp.) and on the larvae of the leaf-beetle, *Galerucella decora.*

Coreidae[2]

*Merocoris distinctus Dall. (H.M.H.), (E.H.N.S.) 8, 10. VI-VII.
*Leptoglossus occidentalis Heid. (E.S.) 2. VI.
*Chelinidea vittiger Uhl. (H.M.H.) 2. V-VIII.

Very abundant on cactus, (*Opuntia* sp.)

Nissoscolopocerus apiculatus Barb. 2. IV.
*Coriomeris humilis Uhl. (G.), (H.M.H.) 2, 3, 6, 20. VI-VIII.

Alydidae[2]

*Megalotomus quinquespinosus Say (H.M.H.) 2, 3. VIII.
*Alydus pluto Uhl. (H.M.H.) 3, 8, 12, 15, 20. VI-VIII.
* eurinus Say (H.M.H.) 2, 3, 21. VIII-IX.
* obesus Fr. (E.H.N.S.) 3, VIII.
* conspersus Mont. (G.), (H.M.H.), (E.H.N.S.) 1-3, 6. VII.
* infuscatus Parsh. (E.H.N.S.) 3, 6, 15, 17. VII.

scutellatus V.D. "Alta."
*Tollius curtulus Stal. (H.M.H.) 2. VIII.
*Stachyocnemus apicalis Dall. (H.M.H.) 2. IX.

Corizidae.[2]

*Harmostes reflexulus Say (G.), (H.M.H.), (W.) 2, 3, 6, 18. VI-VII.
*Corizus viridicatus Uhl. (H.M.H.) 2, 3, 6, 18. VI-VIII.
* crassicornis L. (G.) = punctiventris Dall. (H.M.H.) 3, 9, 10, 15, 18. V-IX.
* indentatus Hanb. (H.M.H.) 2, 3, 6. VIII-IX.

This has twice been reported entering grocery stores in the fall and assembling on cloth sacks which had contained sugar or salt. They were not observed to attempt feeding but they remained on the sacks until they died.

*Leptocoris trivittatus Say (G.), (H.M.H.) 2-5, 8. V-XI.

Adults are frequently a serious nuisance when they congregate in buildings in the fall. Churches and schools, in particular, have been affected.

Aradidae.

*Aradus funestus Berg. (H.P.), (H.M.H.) 2, 6, 10, 18, 19. IV-VI.

Enters houses very freely and is common on windows in early summer.

* quadrilineatus Say (H.M.H.) 1, 10, 18. V-VI.
tuberculifer Kby. 10, 19. IV.
* lugubris Fall. (H.M.H.) 3, 10, 18-20. VI-VII.
* nigricornis Reut. (H.M.H.) 10, 18. IV-VI.
* abbas Berg. (E.S.) 10, 19. VII-VIII.
* proboscideus Walk. (H.M.H.) 6, 10, 18-20. IV-VII.
* heidmanni Berg. (H.M.H.) 18, 19. VII-VIII.
gracilis Parsh. 18. V.
insolitus V.D. 10. III-IV.
nigrinus canadensis Parsh. 18. VIII.
parshleyi V.D. 10.
* persimilis V.D. (H.B.) 10, 18. IV.
serratus Using. 19. V.
uniannulatus Parsh. 2, 10, 20. IV-V.
*Aneurus septentrionalis Wlk. (W.) 3, 20. VII.
nr. simplex Uhl. (H.M.H.) 2, 3, 18. VIII.

Neididae.

*Neides muticus Say (E.S.) 6, 18. IV, VII & IX.

Lygaeidae.

Since no consistent attempts have been made to collect in this family of inconspicuous bugs it is probable that the following list is far from complete for this province.

*Lygaeus kalmii kalmii Stal. (H.M.H.), (W.) 2, 3, 18. VII-IX.
Nysius californicus Stal. 3. VII.
* nr. thymi Wolf. (E.S.) 1-3, 5, 20. VII.

Possibly all are *ericae* but there appear to be two species in the series represented.

* ericae Schill. (H.M.H.), (W.) 1-6, 10, 17, 18, 20. V-VII.

Always very abundant on mustard and other weeds in wheat-fields. Transfers to wheat in the spring and again in late summer, producing characteristic feeding marks, but not causing appreciable damage.

* minutus Uhl. (McD.) 3, VII.
coloradensis grandis Bak. 20. VII.
paludicola Barb. 21. VIII.
*Ischnorrhynchus resedae Panz. (H.M.H.) 6, 9, 10. V-VI.
Taken on birch.
*Cymus luridus Stal. (H.M.H.) 8, 10. VI.
angustatus Stal. (W.) 3. VI.
Blissus occiduus Barb. 3, 17. VII.

Originally identified as *B. leucopterus* Say. Does not appear to be of much economic importance here.

*Geocoris bullatus Say. (H.M.H.), (H.B.) 2, 3, 8, 18. VI-VIII.
* discopterus Stal. (H.M.H.) 2. VII.
atricolor Mont. 20. VII.
*Sphaerobius insignis Uhl. (H.M.H.) 2, 3, 8, 12, 20. VI-VIII.
*Ligyrocoris sylvestris L. (H.M.H.), (H.B.), (W.) (E.H.N.S.).
= contractus Say 2, 3, 8, 10, 15, 20, 21. VI-VIII.
diffusus Uhl. (W.) 3, 9. IX.
Zeridoneus costalis V.D. (W.) 3, 10. VIII.

*Peritrechus fraternus Uhl. 3. VI. (McD.)
* saskatchewanensis Barb. (H.M.H.), (H.B.) 3, 8, 10. IV-VII.
*Sphragisticus nebulosus Fall. (H.M.H.), (H.B.) 3, 10, 15. III & XI.
*Uhleriola floralis Uhl. (H.M.H.), (H.B.) 2. VIII-IX.
*Emblethis vicarius Harv. (H.B.) 2, 10. IV.
*Eremocoris ferus Say (H.M.H.) 8, 10, 18, 20. V-VIII.

Tingitidae.

The limited variety of deciduous trees native to Alberta probably accounts for the small number of species in this family which can be recorded from this province.

*Piesma cinerea Say (McD.) 3. V-VI.
Taken in moderate numbers on alfalfa.
Acalypta nyctalis Drake 10. VI.
*Corythucha immaculata O. & D. (W.) 18. VI.
Taken on Balsamorrhiza.
* distincta O. & D. (D.) 2, 3, 18. VI-VIII.
This species heavily infests native mountain hollyhocks and has now spread to cultivated varieties in southern Alberta.
* elegans Dr. (D.) 8, 10, 12. VI-VII.
Infests alders throughout northern Alberta.
* nr. bellula Gib. (E.H.N.S.) 12. VII.
Taken on imported oaks.
* nr. marmorata Uhl. (E.H.N.S.) 10. VI.
Taken on Solidago.
* salicata Gibs. (D.) 10. VI.
*Galeatus peckhami Ashm. Intermediate with uhleri. (H.M.H.) 10. VI.
Taken on wild asters.
* Physatocheila plexa Say (D.) 3, 10. V-VIII.
* variegata Parsh. (E.S.) 10. V.
Taken on pine.
*Monanthia labeculata Uhl. (E.H.N.S.) 5. VI.

Phymatidae.

*Phymata vicina Handl. (E.S.) 2. VII.
* pennsylvanica Handl. (H.M.H.) = erosa L. 2-4, 6, 18. VII-IX.
Captures Phalaenid adults in addition to smaller insects on goldenrod flowers.

Emesidae. (*Ploiariidae*).

*Metapterus uhleri Bnks. (E.S.) 2. III.

Reduviidae.

*Zelus socius Uhl. (G.), (H.M.H.) 2-3. VIII.
* audax Bnks. (G.), (W.) 3. VII.
Hunts prey on open flowers.
*Rhynocoris ventralis Say (H.M.H.) 2, 3, 10, 18. VI-VII.
Frequently taken on alfalfa.
*Fitchia aptera Stal. (E.S.) 2. III.
*Sinea diadema Fab. (H.M.H.) 2, 3, 10. VII-VIII.
A common predator hunting on goldenrod.

Nabidae.[3]

*Pagasa fusca Stein. (H.M.H.) 10. VIII.
Taken most frequently under logs.
*Nabis subcoleoptratus Kby. (McD.) 2, 3, 10, 18. VII-VIII.
* propinquus Reut. (H.M.H.) 10. VIII.
Taken in marshes and slough grass.
* limbatus Dahl. (E.S.) 10, 12. VII-VIII.
* flavomarginatus Sch. (E.S.) 10, 12. VII-VIII.
* ferus L. (H.M.H.) 3, 10, 15, 18, 19. VI-VII.
Frequently hunts on goldenrod flowers.
* pallidipennis Harr. (H.M.H.) 8, 10. VI-IX.
* roseipennis Reut. (H.M.H.) 10, 12. V-VII.
* rufusculus Reut. (H.M.H.) 3, 10. IV.
inscriptus Kby. 6, 10, 12. VI.
* alternatus Parsh. (H.M.H.) 2. XII.

Cimicidae.

*Cimex lectularius L. (E.S.) 2-6, 8, 10, 12, 15. I-XII.
Population steadily declining since advent of general use of DDT but infestations, often in most unexpected places, continue to occur.
pilosellus Horv. 3. V.
*Oeciacus vicarius Horv. (H.M.H.) 10. VII.
Ceiling of a platform shelter at a railroad depot by a lake is heavily infested. Nymphal bugs, in particular, fall occasionally on to people or baggage.

Anthocoridae.

*Anthocoris antevolens White (H.M.H.) 1, 3, 8, 10. VI-VII.
musculus Say. 3 VI. Predator on Aphids in leaf-galls.
*Orius insidiosus Say (K.) 3, 20. VII-VIII.
* tristicolor White (McD.) 3. VII.
*Tetraphleps canadensis Prov. 20. VIII.

Miridae.

The following is, undoubtedly, an incomplete record of the species in this family which have been taken in this province. A substantial collection, sent some years ago to a specialist, was reported to have been lost during a move. Since, at the time, we possessed few authoritatively determined species in our collection, only occasional attempts had been made to name any of it ourselves. In 1951, Mr. E. H. N. Smith rendered us great assistance in reviewing doubtful determinations in many genera while Mr. A. R. Brooks undertook to name species in the genus *Lygus* and generously supplied us with the names of several species that had been taken in this province and of which we had no previous record.

Genera here recorded are listed in accordance with the classification employed by H. H. Knight in his "Plant Bugs, or Miridae of Illinois"[7].

Phyllinae

*Chlamydatus bakeri Berg. (K.) 3, 20. VI-VII.
obliquus Uhl. 18. VII.
pulicarius Fall. 18. VII.
* pullus Reut. (McD.) 3, 6, 20. VI-VII.

Plagiognathus alboradialis Kgt. 20. VII.
guttatipes Uhl. 2. VII.
laricicola Kgt. 20. VIII.
moerens Reut. 20. VII.
* obscurus fraternus Uhl. (McD.), (W.) 3, 10, 20. VII-VIII.
Psallus drakei Kgt. 20. VII.
*Orectoderus obliquus Uhl. (W.) 1, 5, 7, 9, 10, 20. VI-VII.
Taken on sage.
*Coquilettia insignis Uhl. (McD.) 3. VI-VIII.

Dicyphinae

*Dicyphus agilis Uhl. (K.) 10, 18-20. VI-VIII.
* nr. vestitus Uhl. (E.S.) 10. V.

Bryocorinae

Monalocoris americanus, W. & S. 12.

Deraeocorinae

*Deraeocoris histrio Reut. (McD.) 3, 8. V-VIII.
* aphidiphagus Kgt. (E.S.) 3, 10. VI-VII.
Taken while feeding on elm aphis.
* piceicola Kgt. (E.H.N.S.) 18. VII-IX.

Orthotylinae

Strongylocoris atribialis Kgt. "Alta".
* breviatus Kgt. (E.H.N.S.) 10. VII.
* stygicus Say (E.S.) 3, 10. VII-VIII.
Taken on goldenrod.
*Labops hesperius Uhl. (E.S.) = hirtus Kgt. 3, 8, 10, 19-21. VI-VIII.
verae Kgt. 19. VII.
*Ilnacora stalii Reut. (E.H.N.S.) 2. VIII.
Ilnacorella sulcata Kgt. 18. VII.
*Hadronema militaris Uhl. (McD.) 2, 3, 6, 8, 10, 18. VI-VII.
princeps Uhl. 18. VII.
* picta Uhl. (E.S.) 2, 3. VI-VIII.
simplex Kgt. 3.
* uhleri V.D. (E.S.) 5. VI.
*Lopidea nr. balli Kgt. (E.H.N.S.) 2, 3, 10. VII-VIII.
* dakota Kgt. (McD.) 2, 3, 5, 8, 10, 18. VII-VIII.
Frequently breeds abundantly on caragana hedges, causes leaves to turn yellow and may cause some leaf-fall. Less frequently on raspberries.
* lathyri Kgt. (McD.), (E.H.N.S.) 3. VII.
* media Say (E.S.) 3. VIII.
Taken on goldenrod.
* minor Kgt. (McD.) 15, 18. VII-VIII.
Taken on prairie clover.
* serica Kgt. (McD.) 3, 18. VII.
*Melanotrichus albocostatus V.D. (E.H.N.S.) 3. VI.
* coagulatus Uhl. (E.H.N.S.) 3, 10, 18. IX.
Taken on lambsquarters.

* insignis V.D. (E.H.N.S.) 18. VIII.
Orthotylus alni Kgt. 20. VIII.
* nr. candidatus V.D. (E.H.N.S.) 10. VIII.
dorsalis Prov. 20. VII.
mistus Kgt. 20. VII.
* viridis V.D. (E.S.) 10. VI.
Taken on willow.
*Labopidea nr. nigripes Reut. (E.H.N.S.) 6. VII.
nigrisetosa Kgt. 20. VII.
Ceratocapsus drakei Kgt. 20. VII.

Mirinae

*Megaloceroea debilis Uhl. (McD.) 3, 20. VI-VIII.
Collaria meilleurii Prov. "Alta".
Trigonotylus ruficornis Fall. (W.) 3, VI & IX.
*Stenodema trispinosum Reut. (McD.) 2, 3, 8, 10, 19, 20. V-VII.
Abundant in grass everywhere.
* vicinum Prov. (McD.) 3, 10, 19. V-VIII.
Chiefly in low moist meadows.
* virens L. (McD.) 3, 6, 18-20. V-VIII.
*Platytylellus bivittis Stal. (W.) 3, 20. VII.
Taken on fireweed.
borealis Kgt. (W.) 18. VII.
eremicola Kgt. 10, 18. VI-VII.
nigripilus Kgt. 12. VIII.
*Capsus simulans Stal. (A.B.) 3, 8, 10, 20. VI-VIII.
Neoborus amoenus Reut. 3. VII.
Breeding on, and disfiguring, ash.
*Lygus approximatus Stal. (A.B.) 1, 20. VII-VIII.
Breeds on white spruce and larch.
* columbiensis Kgt. (A.B.) 1, 18, 20. VI-VII.
Breeds on Umbelliferae.
* desertus Kgt. (A.B.) 1-3, 10. V-IX.
Breeds on *Chenopodium*, *Artemisia* spp., &c.
* distinguendus Reut. (A.B.), 1, 10, 19, 20. V-VIII.
* elisus V.D. (A.B.) 10. V-IX.
humeralis Kgt. (A.B.) 17, 18. VI-VIII.
* lineolarius P. de B. (A.B.) = oblineatus Say 1-3, 10, 18, 20. VI-VIII.
Very destructive to alfalfa bloom.
* nigropallidus Kgt. (A.B.) 1-3, 6, 18, 19. V-IX.
Breeds on lupins, (*Lupinus argentea.*)
* nigrosignatus Kgt. (A.B.) 3. VII.
Breeds on cultivated mustard.
* pabulinus L. (McD.), (A.B.) 1, 16, 17. VII.
Breeds on *Actaea* sp.
* pulverulentus Uhl. (A.B.) 2. VII.
Breeds on *Salix amygdaloides.*
* rubicundus Fall (A.B.) 3, 6, 10. IV-V.
* rubrosignatus Kgt. (A.B.) 2, 10, 12, 18. V-IX.

* scutellatus Uhl. (A.B.) = *campestris* of auct. 1-3, 6, 17-19. VI-VII.
Breeds on Umbelliferae.
* shulli Kgt. (A.B.) = *hesperus* of auct. 1-3, 6, 17-19. VI-VII.
A serious pest of alfalfa.
striatus Kgt. (A.B.) 18. VII.
* varius Kgt. (A.B.) 1, 2. V-IX.
Breeds on *Potentilla fruticosa.*
atritylus Kgt. 20. VIII.
Taken on *Salix* sp.
confusus Kgt. 20. VIII.
* communis Kgt. (K.), (A.B.) 2, 19, 20. VII-VIII.
Taken on *Cornus* sp.
rubroclarus Kgt. 10. VI.

Lygidea salicis Kgt. (A.B.) 18. VII.

*Pleciocoris rugicollis Fall. (A.B.) 1. VII.

Polymerus balli Kgt. 3. VII.
basivittis pallidulus Kgt. 18. VII.
severini Kgt. 3. VIII.
unifasciatus Fab. "Alta".
* lateralis Hahn. (McD.) 10, 20. VII-VIII.
Taken from bedstraw (Galium boreale).
* venaticus Uhl. (W.) 10, 15. VII.
Taken on goldenrod near lake margins.

Irbisia arcuata V.D. 3. VI.
brachycera, Uhl. 2. V.
* solani Heid. (McD.) 18, 19, 21. VII.
* nigripes Kgt. (McD.) 18. VI-VII.
fuscipubescens Kgt. 19. VII.

*Adelphocoris rapidus Say (McD.) 1, 3, 7, 10, 18,. VII.
Adults often abundant in alfalfa and reduce seed yield.
* superbus Uhl. (E.S.) 2, 3, 10. VII-VIII.
Adults taken in small numbers on alfalfa.

Phytocoris junceus Kgt. 20. VIII.

Gerridae.

*Gerris bueoni Kirk. (D.), (H.M.H.) 10. V.
* comatus D. & H. (D.), (H.M.H.) 10. VIII.
* dissortis D. & H. (H.M.H.) 15. VI.
* notabilis D. &. H. (H.M.H.) 15. VI.
* nyctalis D. &. H. (D.), (H.M.H.) 6. V.
* pinguensis D. & H. (D.), (H.M.H.) 10. V.

Saldidae.

The generic disposition of species is that employed by H. B. Hungerford who examined our small collection in 1949. Other authorities had, earlier, employed a variety of generic names for the same species.

Salda celeripedis T.B. 20. VII.
* bifasciata Thom. (H.B.H.) = Acanthia bellatrix T.B. (McD.)
18. VI-VII.
* bouchervillei Prov. (H.B.H.) = L. coriacea Uhl. (McD.)
3, 8, 18. VI-VII.

* lugubris Say (H.B.) = Saldula bueoni McD. (H.M.H.) 8, 18. VI.
* major Prov. (H.B.H.) = Acanthia and Saldula. 3, 18. VI.
* pallipes Fieb. (H.B.H.) = interstitialis Say (H.M.H.) 2, 10, 20. IV-IX.
obscura Prov. = Saldula. 18. VI.

Notonectidae.

*Notonecta undulata Say (H.M.H.) 3, 6, 10. VI-VIII.
* insulata Kby. (McD.) 3. V.
* kirbyi Hung. (H.M.H.), (W.) 3, 4, 6, 7, 10, 19. VIII-IX.

Belostomatidae.

*Lethocerus americanus Leid. (McD.) 3, 6, 8, 10, 16. V-IX.

Corixidae.[5]

Few attempts have been made to collect aquatic insects in Alberta and most of the records given below are from the collection of Mr. O. Bryant, determined by Dr. Hungerford.

Arctocorisa sutilis Uhl. 12, 15. VI-VIII.
convexa Fieb. 18. VII.
Callicorixa alaskensis Hung. Lost Lake VI.
audeni Hung. 3, 6, 10, 12, 19. IV-IX.
*Cenocorixa bifida Hung. (H.B.H.) 1-3, 6. VI-IX.
dakotensis Hung. 1-3, 12. VII-IX.
* utahensis Hung. (H.B.H.) 1, 3, 6, 18, 19. VII-IX.
Cymatia americana Huss. 1. VI-VII.
*Hesperocorixa laevigata Uhl. (W.) 3, 6. V & IX.
vulgaris Hung. 6. IX.
Sigara alternata Say 2, 3, 6, 10. V-IX.
conocephala Hung. 10, 12. XII.
decoratella Hung. 3, 10. VII-VIII.
trilineata Prov. 12. IX.
washingtonensis Hung. 18. VI.

Suborder HOMOPTERA

Cicadidae.

Okanagana canadensis Prov. 10. VI.
rimosa Say. (W.) 3, 10. VI-VII.
occidentalis Wlk. (McD.) 3. VII.
synodica Say 3. V.
bella Dav. 18, 21. VII.
luteobasalis Dav. 1-3. VI-VII.

Cercopidae.

Aphrophora parallela Say 19.
Taken on spruce.
* permutata Uhl. (G.), (E.B.), (W.) 1, 10, 12, 18. VII-VIII.
Taken on spruce.
* annulata Ball (G.) 10, 12. VI-VIII.
*Lepyronia quadrangularis Say (G.), (E.B.), (W.) 10. VI-IX.
* gibbosa Ball (E.S.) 9. VI.

*Philaronia abjecta Uhl. (E.S.) 10. VII.
* bilineata Say (McD.) 1-3, 10. VI-VIII.
* orbiculata Ball (G.), (E.B.) 2, 10. VII-VIII.
* reticula Ball (G.), (E.B.) 2, 18. VII.
*Clastoptera obtusa Say (E.S.) 10. VIII.
* borealis Ball (E.B.) 10. IX.

Membracidae.

*Ceresa diceros Stal. (E.B.) 2. VIII.
* bubalus Fab. (E.B.) 3, 6. VII-VIII.
* basalis Wlk. (E.B.) 3, 6, 10, 12, 15, 18. VII-IX.
* turbida Godt. (E.B.) 10. VIII.
* brevis Wlk. (G.) 3, 6, 19. VIII-IX.
* femorata Fair. (W.) 18. VIII.
*Stictocephala inermis Fab. (G.), (E.B.) 2, 3, 6, 17. VII-VIII.
pacifica V.D. (McD.) 3, 17. VII.
*Heliria scalaris Fair. (G.), (E.B.) 2, 10. VII.
*Telamona decorata Ball (G.) 2, 10. VIII.
reclivata Fh. 10. VII.
*Palonica pyramidata Uhl. (E.B.) 10. VII.
ampliata Ball 10. VIII.
* tremulata Ball (E.B.) 10, 19. VII-VIII.
* viridia Ball (G.) 3. VII-VIII.
*Publilia modesta Uhl. (E.S.) 2, 3. VII-VIII.
Breeds on wild liquorice, *G. lepidota.*
*Campylenchia latipes Say (E.B.), (W.) 2, 3. VII-VIII.

Cicadellidae.

A moderately large collection in this family had been assembled by about 1940, when Dr. H. Hurtig, then a graduate student at this University, studied our available material. With the aid of the literature we possessed, together with authoritatively named specimens from elsewhere, he was able to name much of our material with a fair degree of certainty. The bulk of this collection was, however, subsequently submitted to an authority for further examination. In transit, much of this material was damaged beyond recognition. Species of which the determination is credited to Hurtig must, therefore, be accepted with a degree of caution though we have included only those regarding which we have no cause to question the accuracy. Undamaged material was reexamined by Mr. B. Beirne in 1951.

In the following list, genera and species are recorded in accordance with the classification given by Oman[9].

Dorycephalinae

*Dorycephalus platyrhynchus Osb. (E.S.) 2. VI.

Helacinae

*Parabolocratus viridis Uhl. (DeL.), (B.B.) 2, 3, 8, 15, 18, 20. V-VI.
* montanus Ball (B.B.) 8, 10. VI.

Agalliinae

*Agalliopsis novella Say (DeL.), (W.), (B.B.) 3, 4, 10. V-VI.
Taken on willow.
Agallia quadripunctata Prov. (H.) 3. VI-VII.

Certagallia bigeloviae Bak. (H.) 3.
*Acertagallia arida Oman (B.B.) 2. VIII.
fuscoscripta Oman (H.) 2-4. VII.
* sanguinolenta Prov. (DeL.), (B.B.) 2-4, 10, 18, 21. VII-VIII.
Taken on sage.

Macropsinae

*Oncopsis fitchi V.D. (B.B.) = pruni Prov. (W.) 10, 16-18. VI-VII.
Taken on birch.
* sobrinus Wall. (B.B.) 10. VI.
Taken on wolf-willow.
* variabilis Fit. (DeL.) 10, 21. VI-VII.
Taken on alders, wolf-willow and birch.
Macropsis basalis V.D. (W.) 3, 20. VI-VII.
Taken on poplar.
canadensis V.D. (W.) 18. VII.
Taken on willow.
erythrocephala G. & B. (W.) 20.
Taken on willow.
* nr. fumipennis G. & B. (B.B.) = suturalis O. & B. (DeL.) 10. VI.
Taken on willow.
nigricans V.D. (W.) 20. VIII.
robusta Break. (H.) 10, 19. VII.
sordida V.D. 21.
Taken on willow.
* tristis V.D. (W.) 3, 20. VII.
* viridis Fit. (H.) 3, 10. VII.

Idiocerinae

*Idiocerus alternatus Fit. (DeL.) 2, 10, 20. III-IV.
Appears on poplar trunks on first warm spring days.
* fitchi V.D. (B.B.) 2. VII.
* lachrymalis Fit. (DeL.), (W.) 1, 3, 10, 12, 18, 20. VI-VIII.
Common on willows and aspens.
* pallidus Fit. (DeL.) 2, 3, 10. VI & IX.
productus G. & B. (W.) 20. VII-VIII.
snowi G. & B. (H.) 3. VII.
* suturalis Fit. (B.B.) 3, 4, 8, 10. VI-VIII.

Iassinae

*Gyponana flavilineata Fat. (B.B.) = striata Burm. (McD.) 3. VIII.
octolineata Say (W.) 2, 3, 10. VII-VIII.
*Gypona melanota Spang. (B.B.) 2. VIII.

Tettigelinae

*Cuerna costalis Fab. = Oncometopia lateralis Fab. (McD.), (DeL.) 2, 3, 6, 8, 10, 19. V-VIII.
Causes slight damage by feeding on wheat stems in late summer. Damage has been mistaken for rust.
septentrionalis Wlk. (H.) 2. VI.

*Draeculacephala angulifera Wlk. (DeL.) 10. VIII.
* crassicornis V.D. (McD.), (DeL.), (B.B.) 10, 19, 20. VII-VIII
* nr. mollipes Say (B.B.) 8, 10. VII-VIII.
* noveboracensis Fit. (McD.), (B.B.) 1-3, 10. VIII.
* prasina Wlk. (B.B.) 1-3, 5, 8, 10. VII-VIII.
*Helochara communis Fit. (DeL.), (B.B.) 2, 3, 5, 8, 10. V-IX.
Is abundant in slough grass.
*Neokolla gothica Sign. (DeL.), (W.), (B.B.) 2, 3, 7, 8, 10. IV-VIII.
Taken on alder, dogwood and aspen.
* hieroglyphica Say (B.B.) 2. VII.
*Keonolla confluens Uhl. (McD.) 3. V.
*Evacanthus acuminatus Fab. (DeL.), (B.B.) 10. VI-VIII.

Cicadellinae

Dikraneura carneola Stal. (B.B.) 2. VII.
mali Prov. (DeL.) 10. VI.
Empoasca smaragdula Fall (H.) 6. VIII.
filamenta DeL. 3. VI.
Injurious to Chinese elm.
* vincula DeL. (B.B.) 10. IV.
*Erythroneura ziczac Walsh. (E.S.) = comes Say. 2, 3. VI-VIII.
A serious pest of Virginia creeper.

Deltocephalinae

*Scaphytopius acutus Say (DeL.), (B.B.) 2, 3, 10, 12. VII-VIII.
Taken on lambsquarters.
* cinereus O. & B. (DeL.) 2. VII.
latus Bak. (H.) 5, 10.
*Acinopterus viridis Ball (B.B.) 2. VII.
Neosteles neglectus DeL. (B.B.) 2. VII.
*Balclutha abdominalis V.D. (DeL.) 10, 15. VI-VII.
Taken on nettles and equisetum.
impicta osborni V.D. (W.) 19. VIII.
* manitou G. & B. (H.) 2, 3. VI-VII.
* punctata Thun. (B.B.) 2, 6-8, 10, 18, 19. V-VI.
*Macrosteles arcuatus G. & B. (B.B.) 10. VII.
* quadripunctatus Fall. (B.B.) = dahlbomi Zett. 12, 20. VII.
binotatus Sahl. (DeL.) 3. VIII.
Taken on beets and potatoes.
* divisus Uhl. (DeL.) = fascifrons complex (B.B.) 2-6, 10, 17, 20. V-VIII.
Frequently recorded from Alberta under the name *Cicadula sexnotata* Fall. as a serious garden pest disseminating "yellows".
* potorius Ball (DeL.), (B.B.) 10. VI.
* variatus Fall. (DeL.), (B.B.) 7, 10. VII.
Taken on carrots and nettles.
Chlorotettix galbanatus V.D. (H.) 8. VII.
* lusorius O. & B. (DeL.) 10. IX.
* unicolor Fit. (W.), (B.B.) 2, 3, 10. VII-IX.

Colladonus clitellarius marcidus Ball (H.) 3.
* montanus V.D. (H.) 2, 3, 10. VII-IX.
*Idiodonus kennicottii Uhl. (DeL.), (B.B.) 15. VII-VIII.
*Ballana venditaria Ball (DeL.) 18. VII.
*Norvellina chenopodii Osb. (B.B.) 2, 8, 10, 12. VIII.
*Paraphlepsius apertus V.D. (DeL.) 10. VIII.
* irroratus Say (McD.) 10, 17. VIII.
* lascivus Ball (DeL.), (B.B.) 2, 3. VII.
* solidaginis Wlk. (B.B.) = nebulosus V.D. 2, 3, 6. VII.
*Cicadula ciliata Osb. (B.B.) 2, 3. IX.
* decipiens Prov. (DeL.), (B.B.) 10, 19. VIII-IX.
* longiseta V.D. (B.B.) 6. VIII.
* straminea S. & DeL. (B.B.) = melanogaster Prov. (DeL.) 10, 19. VIII-IX.
* stylata DeL. (B.B.) 2, 19. VII-IX.
*Thamnotettix prasina Fall. (B.B.) = simplex H.-S. & chlamydatus Prov. (DeL.) 10, 12, 19. VIII-IX.
*Extrusanus extrusus V.D. (B.B.) 3, 8, 9, 10. VI-VIII.
Frigartus frigidus Ball (B.B.) 2.
Limotettix parallelus V.D. (DeL.) 10. VI-VII.
* striolus Fall. (B.B.) 2, 10. VIII.
* uneolus Ball (B.B.) = divaricatus S. & DeL. (DeL.) 2, 3, 6, 10. VII-VIII.
*Scleroracus angustatus Osb. (B.B.) 5, 20. VII-VIII.
elongatus Osb. (W.) 20. VII.
*Exitanus exitosus Uhl. (B.B.) 3.
Athysanella bifida B. & B. (B.B.) 2.
attenuata Bak. (B.B.) 2.
obesa B. & B. (B.B.) 2.
occidentalis Bak. (B.B.) 2.
curvata B. & B. (B.B.) 2.
*Palus bilineatus G. & B. (DeL.) 10. VI.
Orocastus perpusillus B. & DeL. (B.B.) 2.
*Auridius auratus G. & B. (DeL.), (B.B.) 10. VI.
Taken on prairie grass.
Mocuellus flavidus Beir. 2. VII.
ordinatus Ball. 6.
canadensis DeL. (W.) 20. VII.
collinus Boh. (H.) 2, 3. VI-VII.
*Psammotettix striatus L. (DeL.) 2-6, 8, 10. VI-IX.
Taken on a great variety of plants, including grass, alfalfa and willows.
*Sorhoanus debilis Uhl. (DeL.) 3, 8, 10. VI-VII.
Taken on prairie grass.
* orientalis DeL. & D. (B.B.) = Verdanus abdominalis Fab. (DeL.), 1, 5, 8, 10. VI-VII.
* uhleri Oman (B.B.) 2, 3, 8, 10. VI-VII.
Cazenus cicatrix DeL. & S. 12.

*Verdanus evansi Ash. (B.B.) 1, 3, 8, 10, 15. VI-IX.
Taken on sage.
*Diplocolenus configuratus Uhl. (DeL.), (B.B.) 2, 8, 10. VI-VII.
Taken on prairie grass.
Flexamia flexulosa Ball (B.B.) 2.
*Errastrunus ocellaris Fall. (DeL.), (B.B.) 10, 18, 20. VI-VII.
* sobrinus DeL. & S. (B.B.) 10, 12, 19. VII-VIII.
*Quontus misellus Ball (H.) 6, 8, 10. VII-VIII.
Hebecephalus borealis DeL. & D. "Alta".
* nr. occidentalis B. & T. (B.B.) 8, 10. V.
rostratus B. & T. (B.B.) 2.
signatifrons V.D. (W.) 2-4, 20. VI-VIII.
* truncatus B. & T. (B.B.) 2, 3, 10. V-VIII.
Commellus sexvittatus V.D. (B.B.) 2.
*Cabrulus labeculus DeL. (H.) 2, 19. VII-VIII.
Deltocephalus balli V.D. (B.B.) 2.
castoreus Ball (H.) 10.
*Endria inimica Say (B.B.) 2, 3, 6, 8, 10. VII.

Fulgoridae[8]

In 1937[10], the writer recorded the twelve species of Fulgorids which were then known to be native to Alberta. Subsequent examinations of likely habitats for representatives of this family have already produced 32 species.

*Scolops angustatus Uhl. (Z.M.), (V.D.) 1, 2, 5. VIII.
hesperius Uhl. 3.
* grossus Uhl. (Z.M.) 2. VIII.
Taken on sweet clover.
*Epiptera pallida Say (V.D.) 1, 8. VI.
* septentrionalis Prov. (V.D.) 8. VI.
Both of the above were taken on rushes.
*Oliarus franciscanus Stal. (Z.M.) 10. VI-VII.
Taken on sage.
* humilis Say (E.S.) 2, VIII.
*Cixius misellus V.D. (E.S.) 2, 3. V & IX.
* nervosus L. = basalis V.D. (Z.M.) 10, 16. VI-VIII.
Taken on sage and spruce, usually on former.
cultus Ball (McD.) 3. V-VII.
*Apache degeeri Kby. (Z.M.) 10. VIII.
*Stenocranus aurundineus Met. (E.S.) 2. VI.
* dorsalis Fit. (Z.M.) 10. V-VII.
Taken on prairie grass.
* felti V.D. (R.B.) 8, 10. V-VI.
*Pissonotus marginatus V.D. (V.D.) 2. VII.
* basalis V.D. (Z.M.) 3. VIII.
Taken on gumweed (*G. squarosa*).
brunneus V.D. (W.) 3.
* aphidioides V.D. (Z.M.) 10. VII.
Taken only on Indian paintbrush (*C. coccinea*).
*Phyllodinus nervatus V.D. (Z.M.), (R.B.) 10. VI-VII.
Taken from grass under trees.

*Laccocera vittipennis V.D. (Z.M.), (V.D.) 2, 10, 15. VI.
* zonata V.D. (R.B.) 2. VI.
flava Cwfd. 2, 3.
*Delphacodes kilmani V.D. (Z.M.) 10, 15. V-VII.
Breeds abundantly on mares' tail. (*Equisetum* spp.)
* neocclusa M. & G. (R.B.) 3, 8. IV-V.
* arcanastyla Beam. (R.B.) 10. V.
* pellucida Fab. (Z.M.), (V.D.) 1-3, 5, 8, 10. V-VII.
Widespread wherever cinquefoil (*Potentilla* spp.) is growing.
stricklandi Met. 10. VI.
* campestris V.D. (Z.M.), (V.D.) 2, 8. VI-VIII.
Taken commonly from prairie grass.
* analis Cwfd. (R.B.) 10. V.
*Archortile albosignata Dahl. (E.B.) 15.
*Criomorphus inconspicuus Uhl. (R.B.) 10. VII.
*Pentagramma vittatifrons Uhl. (R.B.) 2. VIII.

Chermidae (*Psyllidae*).

In 1938[11] and 1939[13] the writer recorded 39 species of Chermidae which he had taken in Alberta. In these lists their host relationships were discussed. The following list contains one additional entry, only.

*Aphalara artemisiae Forst. (C.) 10. VI-VII.
* confusa Cald. (C.) 10, 12. VII-VIII.
* curta Cald. (C.) 15.
* dentata Cald. (C.) 3. VI.
* fumida Cald. (C.) 9, 10, 16. VI.
* nr. gutierreziae Kly. (C.) 2. VIII.
* hebecephala Cald. (C.) 9, 10. VI-VII.
* loca Cald. (C.) 10. V-VII.
* manitobaensis Cald. (C.) 10. V.
* nebulosa kincaidi Ash. (C.) 10, 15. VI.
* rumicis Mall. (C.) 7, 10. VII.
* simila Cald. (C.) 10. V-VI.
* vancouverensis Kly. (C.) 10, 15. VI.
* veaziei Patch (C.) 10. VI-VII.
*Calophya triozomima Sch. (C.) 3. VIII.
*Paratrioza cockerelli Sulc. (C.) 2, 3, 5, 6, 8, 10. I-XII.
*Trioza quadripunctata Cwfd. (C.) 10, 12. V-VII.
* frontalis Cwfd. (C.) 10. V-VI.
* sulcata Cwfd. (C.) 10. IX-X.
* nr. similis Cwfd. (C.) 10. VIII.
* nr. maura Forst. (C.) 10. VI.
* varians Cwfd. (C.) 10, 15, 19. IV-VII.
*Phylloplecta multidubiata Cald. (C.) 10. V.
* breviradia Cald. (C.) 10. V-VI.
*Arytaina ribesiae Cwfd. (C.) 3. VII.
*Psyllia nr. fibulata Cwfd. (C.) 10. VI.
* sinuata Cwfd. (C.) 10, 20. VI-VII.
* alba Cwfd. (C.) 10, 15. VI-VII.

* hartigii Flor. (C.) 10. VI.
* americana Cwfd. (C.) 10, 19. IV.
* flava Cwfd. (C.) 10, 19. IV-V.
hamata Tuth. 19. IV.
* magnicauda Cwfd. (C.) 3, 7, 10. VI-VII.
* striata Patch (C.) 10. VI.
* stricklandi Cald. (C.) 10, 16, 21. VI-VII.
* virida Cald. (C.) 3. VIII.
* negundinis Mall. (C.) 7, 10. VI-VII.
* floccosa Patch (C.) 10, 21. VI-VII.
* cerasi Patch (C.) 10. IX.
* astigmata Cwfd. (C.) 10. VII.
* alni americanella Str. (C.) 12, 20, 21. VII.

Aphididae.[4]

The only systematic attempt to collect data on the species of this important family in Alberta has been that of Mr. T. R. Davidson, a graduate student at this University, who in 1944 made a fairly comprehensive collection of the species then in evidence in the neighbourhood of Edmonton. With the aid of available literature he was able to name, with reasonable certainty, the bulk of our collection. Additional material was loaned by the Dominion Entomological Laboratory at Lethbridge and in the following year Mrs. McGillivray of the Dominion Entomological Laboratory at Fredericton, N.B. generously re-examined all of our material in order to verify or to correct determinations.

In the following list, genera are arranged in conformity with Hottes and Frison's publication on the Plant lice of Illinois.[4]

*Cinara laricis Hart. (E.S.) 10. V.
Taken on imported larch.
* palmerae Gill. (E.S.) 10. V-VI.
Extremely heavy infestation of several large spruces in gardens in Edmonton in 1951.
*Clavigerus bicolor Oest. (P.M.) 19. VII.
Migrants taken on Columbia Ice Field at 10,000 ft.
* smithiae Mon. (P.M.) 3, 4, 6, 8, 10, 19. VI-VIII.
This is a serious pest of Russian poplars. It kills young growth if the trees are suffering simultaneously from some other handicap such as drought or hail. Migrants were taken with *bicolor* at 10,000 ft.
*Periphyllus negundinis Thom. (E.S.) 3, 6, 8, 10. V-IX.
This is a disagreeable and widespread pest of Manitoba maples. The trees do not appear to be seriously affected but copious honeydew falls continually.
* populicola Thom. (McG.) 6, 10. VII.
Infests N.W., and less frequently, Russian poplars.
*Aphis abbreviata Pat. (McG.) = rhamni Fons. 10. VI.
Infesting tomatoes.
forbesi Weed. 2, 3, 10, 19. VI.
Strawberry root aphis.
* nr. heracella (McG.) 3. IX.
Taken from celery.

* maculatae Oest. (McG.) 10. V.
Taken on dogwood, but recorded from poplar.
* maidis Fit. (McG.) 3, 10. VIII.
Infests corn in S. Alberta and colonies were found during the winter on greenhouse-grown barley at Edmonton.
* oenotherae Oest. (P.M.), (McG.) 10. VII.
* ribiensis G. & P. (McG.) 3. IX.
Taken on red currants.
* sensoriata G. & B. (McG.) 10. IX.
Taken on beans.
viburnicola Gill. 3. IX & V.
Apparently overwintering on *Viburnum* Sp. (Snowball).
*Brachycolus tritici Gil. 6. VI.
Since 1944, when it was first observed, a localized infestation of wheat has occured near Cowley but it does not appear to be spreading.
*Brevicoryne brassicae L. (McG.) 3. VII-IX.
Occasionally infests cabbages and cauliflowers heavily and turnips more lightly.
* symphoricarpi Thom. (McG.) 10. VII.
Taken from pincherry.
*Cavariella aegopodii Scop. (McG.) 10. II.
Taken on carrots in a greenhouse.
* capreae Fab. (McG.) 3, 6. IX.
Taken on carrots and celery in greenhouse.
*Hyalopterus atriplicis L. (McG.) 10. VII.
Breeding on Lambsquarters (*C. album*).
* hyperici Mon. (D.) 3. VI.
Taken on plum.
*Rhopalosiphum enigmae H. & F. (McG.) 10. VII.
* prunifoliae Fit. (McG.) 10. IX.
Taken on Pincherry, Alders and Clover.
* pseudobrassicae Dav. (McG.) 3, 7. VI-IX.
In addition to occasional severe infestations of cabbages and turnips, this has been found breeding on stinkweed.
* scirpifolii G. & B. (McG.) 3. IX.
Taken on greenhouse grown celery.
Myzocallis ulmifolii Mon. 3. VII-VIII.
Breeding on elm and producing copious honeydew.
*Amphorophora cosmopolitana Mason (McG.) 3. IX.
On black currants and greenhouse grown celery.
* rubicola Oest. (McG.) 8. VI.
Taken on raspberry.
*Capitophorus flaveolus Wlk. (McG.) 3, 10. VIII-IX.
Taken on Canada thistle, potato, beans and bullberry.
* fragaefolii Ckll. = Myzus rosarum Kalt. (McG.) 10. VI.
Taken on tea-rose but not on other cultivated varieties which were growing in its immediate vicinity.
* ribis L. (D.) 2, 3, 5, 10. VIII.
Common on currants and *Polygonium* spp.

*Macrosiphum caraganae Chol. 3, 10. VI-X.

This species is recorded in the literature as the most frequent cause of caragana defoliation in Saskatchewan and Alberta. All of the specimens we have taken from caraganas which were being rapidly defoliated at Edmonton have been *M. pisi* Kltb.

*Macrosiphum dirhodum Wlk. (McG.) 10. VII.

Taken on rose and potato.

eoessigi Knowl. 3, 18. VII.

Infests wild and cultivated hollihocks.

* granarium Kby. (McG.) 2-5, 10, 12, 15. VII-IX.

Heavily infests all kinds of grain in certain years. It is improbable that this species can overwinter anywhere in Alberta.

* pisi Kltb. (McG.) 3, 10. VI-VII.

Appears to overwinter on alfalfa and to migrate during the summer to peas and caragana. May defoliate the latter.

* rudbeckiae Fit. (McG.) 10. VII.

* solanifolii Ash. (McG.) = gei Kock. 3, 6, 8, 10. VI-VII.

Cultivated roses are usually infested every spring in the larger cities and towns of Alberta. This species is, however, very uncommon on wild roses. A serious disease-transmitting pest of potatoes and tomatoes.

* solidaginis F. & W. (McG.) 10. VIII.

The wine-coloured apterae of this species are rather evenly distributed along the stems of cultivated asters.

*Myzus convolvuli Kltb. (McG.) 2, 10. VIII-IX.

Taken on tomatoes and beans.

* cynosbati Oest. (McG.) 10. VII.

Taken on currants.

* essigi G. & P. (McG.) 10. VI.

Taken on wild and cultivated columbine.

* persicae Sulz. (McG.) 2, 10. VIII-IX.

Taken on tomatoes and potatoes.

*Eriosoma americana Ry. (McG.) 2-4, 8, 10. VI-IX.

Elms to saskatoon roots.

* lanigera Haus. (McG.) 3, 10. VI-IX.

This is more abundant on elms at Edmonton than is *E. americana*. The ground surrounding the trunks of these trees is frequently covered to a depth of up to about two inches and to a distance of about 9-10 inches from the trunk itself with winged migrants at about the middle of September.

Forda occidentalis Hart. 2, 3. VII.

This was first observed infesting wheat roots in 1934, but it has not proved to be very injurious in Alberta.

*Mordwilkoja vagabunda Walsh. (E.S.) 3, VII.

The sponge galls of this species are very conspicuous in certain years in the drier parts of the province.

*Pemphigus betae Doane 3. V-IX.

A pest of increasing importance to beet production in Southern Alberta, first recorded in 1934. Overwinters on *Populus angustifoliae* and *P. balsamifera*, forming a mid-rib gall.

* brevicornis Hart. (McG.) 3, 10. VIII-IX.

This species has been taken on potatoes, beets and celery in Alberta. Hottes and Frison[4] state that this may be the sexuipara of *P. populicaulis* Fit.

* ephemeratus H. & F. (McG.) 10. VIII-IX.

In certain years the subterranean apterae are extremely abundant on the roots of petunias and larkspurs where they produce a flocculent white wax which covers much of the surrounding soil.

* populicaulis Fit. (McG.) 2, 3. VII.

Hottes and Frison think that this may be synonomous with *P. lactucae* Fit. It forms an irregular stem gall at the immediate base of poplar leaves. On *Populus balsamifera* the gall is seen to be formed by the flattening and twisting of the stem. The migrants leave this as the stem is unwrapped in late summer.

* populitransversus Ry. (E.S.) 2, 3. VII.

A marble gall is formed on the stem of poplar leaves usually at a little distance from the base of the leaf. Migrants leave by a transverse slit in the wall of the gall.

* populivenae Fit. (McG.) 10. VII.

Recorded as having produced "pseudogalls" on poplar leaves at Edmonton.

*Thecabeus populimonilis Ry. (McG.) 3, 10. VII.

In 1948, poplars of the balm of Gilead type in the Elk Island National Park were very heavily infested with marble galls along the midribs of the leaves. They usually occurred in series of from four to five to a leaf and some trees were so heavily infested that they appeared to be carrying bunches of grapes. Mrs. McGillivray confirmed our determination that these were produced by *T. populimonilis* Ry. It did not, however, form a "cockscomb" gall as is claimed for it in the literature.

* populiconduplifolius Cow. (McG.) 10. VII.

Taken on Swiss chard.

Mindarus abietinus Koch. "Alta".

Phylloxeridae.

*Adelges abietis L. 10, 12, 15-17, 19. VII-VIII.

Widespread on all types of spruce.

* cooleyi Gill. 3, 8, 19-21. VII-VIII.

Common on spruces, transferring to Douglas fir.

nr. pinicorticis Fit. 8. VII.

On transplanted pine.

Pineus pinifoliae Fit. North-west Alberta.

similis Gill. 6. VII.

On white spruce.

Aleyrodidae.

We have no records of any species in this family that are native to Alberta.

*Trialeurodes vaporariorum L. (E.S.) 2, 3, 5, 8, 10, 15. I-XII.

Now present in nearly all greenhouses and often introduced into dwellings.

Coccidae.

No systematic attempts have been made to collect the native species of this family in Alberta. In recent years, one or two scale insects have attracted attention as pests of economic importance in the "field", but interest has centred chiefly on those species which have been accidentally introduced into greenhouses.

*Pseudococcus citri Riss. 2, 3, 5, 6, 8, 10, 15. I-XII.

Now widely prevalent in greenhouses.

longispinosus Targ. 10. VII.

Has been reported to us from one greenhouse only.

*Lecanium coryli L. (E.S.) 3. VI.

Infesting caraganas and elms.

corni Bouch. 6, 7, 10. VIII.

Infesting dogwood and, to a less extent, Manitoba maple.

Pulvinaria vitis L. 3. VI.

Infesting Manitoba maple.

*Saissetia hemispheric ae Targ. (E.S.) 10. VII-IX.

On a variety of greenhouse and house plants.

*Phenacapsis pinifoliae Fit. 4-9. VI-VII.

Becoming increasingly abundant on transplanted spruce and pine.

*Hemichionaspis aspidestriae Sign. (E.S.) 3, 6, 10. I-XII.

More prevalent on Boston ferns in houses than in greenhouses.

Lepidosaphes ulmi L. 3. III-VII.

Heavily infests cotoneasters.

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The North American Species of *Cicadula* (Homoptera: Cicadellidae)[1]

By BRYAN P. BEIRNE[2] AND DAVID A. YOUNG, JR.[3]

In routine work on leafhoppers of the genus *Cicadula* Zetterstedt (1840, p. 296) (= *Cyperana* DeLong, 1936, p. 218) it was impossible to name many specimens satisfactorily. The chief reasons were the inadequacy of the descriptions in the literature and the fact that the extent of the individual and the local variation had not been appreciated. Because of the latter, some species apparently had been described under several names.

The following are keys to the species and descriptions of the characteristics of each, together with notes on the nature and extent of the variation. Examination of a large number of specimens, including type material of most of the American species, showed that two North American species are synonymous with European species, seven North American species are synonymous with these or with other North American species, one European species is synonymous with a North American species, and two European species are synonymous with a third. The number of known North American species is reduced to eight, from the 13 species and one variety listed by Oman (1949).

Species of this genus, all of which apparently inhabit marshy situations and occurr mainly in the Boreal region, are rather uniform in general appearance. They are yellowish-green or yellowish insects that average about 5 mm. in length and have a black band or a row of black spots across the anterior margin of the vertex. A few species can be recognized by colour or markings but the majority can be identified reliably only by examination of the genitalia. The seventh abdominal sternum of the female usually shows reliable specific characters, despite published statements to the contrary. In the male, reliable specific characters are shown by the aedoeagus, pygofers, styles, or plates, and usually by all these structures. Incidentally, the "outer finger process of the style", hitherto used as a taxonomic character, does not exist as such; it appears to be a fold on the inner surface of the plate. Variation is both local and individual. It occurs in size, in colour, in degree of development of the dark markings, and, to a lesser extent, in the shapes of various parts of the body, including parts of the genitalia.

Key to Females

1. Vertex, pronotum, and scutellum with three longtitudinal brownish or reddish bands (Fig. 3) ..... 3. *cyperacea* (Osb.)
   Dorsum without such bands 2
2. Vertex with black band across anterior margin (Fig. 11); seventh sternum relatively long, with two areas of weak striae (Fig. 21) ..... 1. *smithi* (Van D.)
   Vertex with black spots at anterior margin, or seventh sternum not as above 3
3. Seventh sternum with a band of longitudinal striae across posterior margin (Fig. 26) ..... 5. *intermedia* (Boh.)
   Seventh sternum not as above, with two striated areas or without striae 4
4. Seventh sternum without striae 5
   Seventh sternum with distinct striae 6
5. Seventh sternum with posterior margin deeply excavated and with a small median projection, usually dark with the posterior margin and the projection, and often a median band, whitish (Fig. 31); vertex usually with two spots on anterior margin (Fig. 19) ..... 7. *quinquenotata* (Boh.)

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Seventh sternum with posterior margin almost truncate, usually with a broad, dark, longitudinal, median band and with the sides yellow (Fig. 32); vertex usually with few spots on anterior margin (Fig. 20) ..... 8. *longiseta* (Van D.)

6. Seventh sternum with posterior margin strongly excavated at each postero-lateral corner, sculpture as two longitudinal striae from each of which shorter striae diverge postero-laterally (Fig. 22) ..... 2. *melanogaster* (Prov.)
Seventh sternum not, or not strongly, excavated at postero-lateral corners, sculpture not as above but as two rounded or ovoid striated areas 7

7. Striated areas of seventh sternum with ridges prominent and grooves deep, more or less radiating from a raised prominence (Figs. 27-30); usually larger species, 5.0-6.8 mm. in length ..... 6. *straminea* (Sand. & DeL.)
Striated areas of seventh sternum with ridges less prominent and grooves less deep, without obvious raised prominence (Figs. 24, 25); usually smaller species, 4.8-5.5 mm. in length ..... 4. *ciliata* (Osb.)

Key to Males

1. Vertex, pronotum, and scutellum with three longitudinal brownish or reddish bands (Fig. 3) ..... 3. *cyperacea* (Osb.)
Dorsum without such bands 2

2. Vertex with black band across anterior margin (Fig. 11) ..... 1. *smithi* (Van D.)
Vertex with black spots at anterior margin 3

3. Apical region of aedoeagus trifurcate; plate without apical process (Figs. 59, 60) 4
Apical region of aedoeagus simple, not trifurcate; plate with short apical process 5

4. Pygofer with spine-like process arising from upper margin before apex and a downwardly directed, spine-like process at apex (Fig. 42); apical processes of aedoeagus very slender (Fig. 51); margin of vertex usually with two spots (Fig. 19) ..... 7. *quinquenotata* (Boh.)
Pygofer without such processes (Fig. 43); apical processes of aedoeagus stout (Fig. 52); margin of vertex usually with four spots (Fig. 20) ..... 8. *longiseta* (Van D.)

5. Pygofer expanded at apex (Figs. 39-41); style with broad, blunt apical region (Fig. 66) ..... 6. *straminea* (Sand. & DeL.)
Pygofer more or less tapered to apex, not expanded; style more distinctly tapered, with small, sharp, lateral tooth at apex 6

6. Aedoeagus weakly sinuate, more nearly straight, with longer basal portion (Fig. 45); plate relatively narrow, with longer apical process (Fig. 54); pygofer more evenly tapering to rounded apex (Fig. 35) ..... 2. *melanogaster* (Prov.)
Aedoeagus evenly curved, with shorter basal portion; plate relatively broader, with shorter apical process; pygofer less evenly tapering, its upper margin almost straight 7

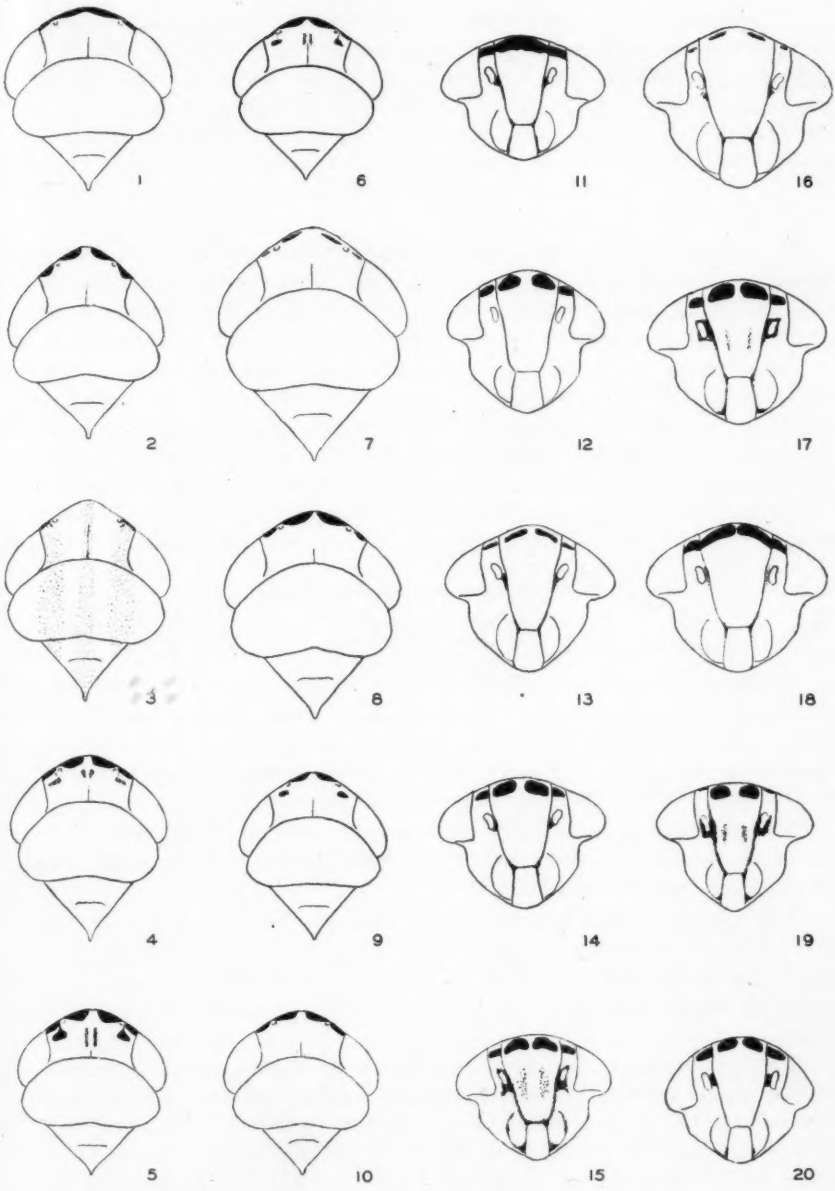
7. Aedoeagus shorter and more nearly straight (Fig. 48); style more distinctly tapering toward apex (Fig. 65); lower margin of pygofer more nearly straight from apex (Fig. 38) ..... 5. *intermedia* (Boh.)
Aedoeagus larger and more distinctly curved (Fig. 47); style less distinctly tapering toward apex (Fig. 64); lower margin of pygofer distinctly bluntly angled below apex (Fig. 37) ..... 4. *ciliata* (Osb.)

1. *Cicadula smithi* (Van D.)

Figs. 1, 11, 21, 33, 34, 44, 53, 61

Thamnotettix smithi Van Duzee, 1892: 266.
Thamnotettix vittipennis Sanders and DeLong, 1917: 91. New synonymy.

A moderately large species, 5.0-5.8 mm. in length. General colour yellowish-green, with a black band at anterior margin of vertex. This black band is virtually distinctive, though a similar band occurs rarely in some other species (e.g., *intermedia* and *straminea*) as an individual variation. The form of the seventh sternum of the female is distinctive. It resembles somewhat that of *longiseta* but differs in the presence of the two striated areas, and usually in colouring. The forms of the aedoeagus, of the apical region of the pygofer, and of the style distinguish the male from the varieties of other species that have the black band on the vertex margin.



Figs. 1-20, *Cicadula* spp. (drawings to same scale). 1-10, head, pronotum, and scutellum of: 1, *C. smithi* (Van D.); 2, *C. melanogaster* (Prov.); 3, *C. cyperacea* (Osb.); 4, 5, *C. ciliata* (Osb.); 6, *C. intermedia* (Boh.); 7, 8, *C. straminea* (Sand. & DeL.); 9, *C. quinquenotata* (Boh.); 10, *C. longiseta* (Van D.); 11-20, head, from the front, of: 11, *C. smithi;* 12, *C. melanogaster;* 13, *C. cyperacea;* 14, *C. ciliata;* 15, *C. intermedia;* 16, 17, 18, *C. straminea;* 19, *C. quinquenotata;* 20, *C. longiseta.*

The shape of the vertex, and the size vary slightly. The general colour varies from greenish to yellowish or yellowish-brown. The forewing is often tinged with brownish between the veins, especially toward the apex. Frequently there are black or dark-brown markings on the frons on both sides of the mid line, and the facial sutures may be marked with black. Occasionally the black band at the vertex margin is broken at the middle, or at the sutures, or both. Occasionally there is a pair of small brownish or black markings in the middle of the disc of the vertex near the anterior margin.

A paratype of *vittipennis* was examined. No structural differences between it and *smithi* could be found. As originally described, the distinctive feature of *vittipennis* appears to have been a tawny suffusion in the disc of the vertex and on the pronotum. This is within the normal range of colour variation of *smithi*.

This species has a northern transcontinental range. Specimens from the following localities were examined. CANADA:—British Columbia: Chimney Creek, Cowichan, Kersley, MacAllister, Merritt, Quesnel, and Shawnigan; Manitoba: Churchill, Clear Lake, and Cowan; Ontario: Bradford. UNITED STATES:—Colorado: Muddy Pass and Pingree Park; Iowa: Ames; Michigan: Cheboygan Co.; Minnesota: Itasca Park; Pennsylvania: Presque Isle; Washington: Hoquiam and Kalama; Wisconsin: Green Bay, Madison, Muscego, Sullivan, and Trout Lake.

2. *Cicadula melanogaster* (Prov.)

Figs. 2, 12, 22, 35, 45, 54, 62

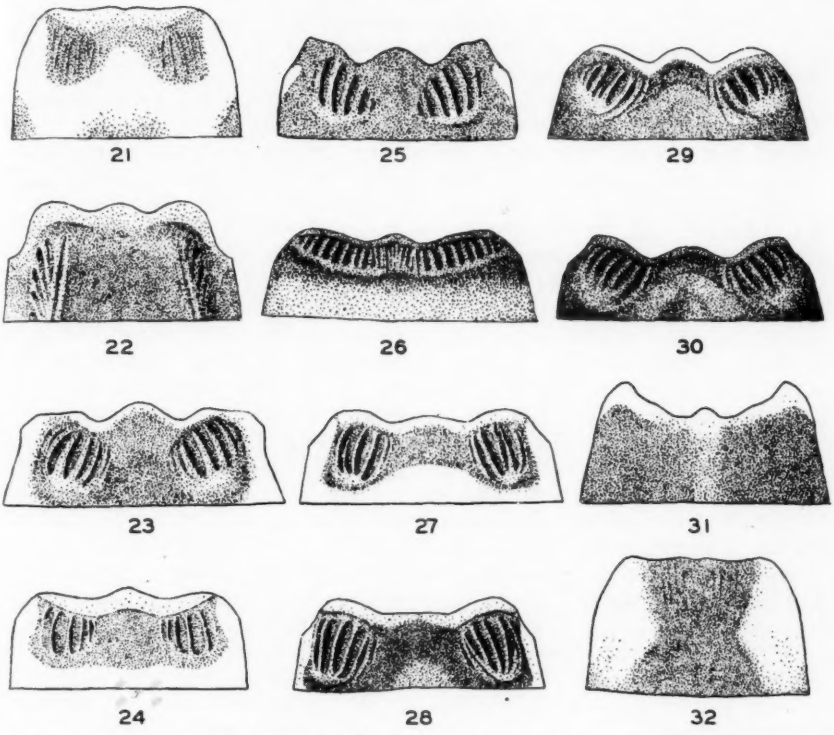
Jassus melanogaster Provancher, 1872: 878.

A relatively small species, 4.2-5.0 mm. in length. General colour yellowish or greenish-yellow, with four ovoid, black spots at the anterior margin of the vertex. The most reliable distinctive characters are the shape and sculpture of the seventh sternum of the female, and the forms of the aedoeagus and of the apical region of the pygofer of the male.

Variation appears to be slight. There is some variation in the general colour, and in the size of the black spots of the vertex margin, and the facial sutures are sometimes marked with black.

The holotype, which is in the Quebec Provincial Museum, was not available for examination. It was examined by Van Duzee (1912), who indicated that it was of the species that he took to be *melanogaster*, which, presumably, is the species treated as *melanogaster* by subsequent authors and discussed here as that species.

The species has a wide distribution in eastern North America. Specimens from the following localities were examined. CANADA:—Ontario: Leamington and Vineland; Quebec: Clarenceville and Hull. UNITED STATES:— Connecticut: Storrs; District of Columbia: Washington; Illinois: Algonquin; Indiana: Kosciusco Co.; Iowa: Ames, Buffalo Center, Co. no. 60, Iowa Co., Lake Amana, and seven miles N.-W. of Thompson; Michigan: Agricultural College; New Hampshire: Center Harbour; New Jersey: Cookstown; New York: Buffalo, Canton, Maspeth (Long Island), and Salem; Ohio: Barberton and Columbus; Pennsylvania: Honesdale and Patton; Tennessee: Clarksville and Hixon; Virginia: Page Co. and Warrenton; Wisconsin: Amery, Florence, Grand Rapids, Green Bay, Madison, Milwaukee, Osceola, St. Croix Fl., and Sullivan.



Figs. 21-32, seventh sterna of females of *Cicadula* spp. 21, *C. smithi* (Van D.); 22, *C. melanogaster* (Prov.); 23, *C. cyperacea* (Osb.); 24, 25, *C. ciliata* (Osb.); 26, *C. intermedia* (Boh.); 27, 28, 29, 30, *C. straminea* (Sand. & DeL.); 31, *C. quinquenotata* (Boh.); 32, *C. longiseta* (Van D.).

3. *Cicadula cyperacea* (Osb.)

Figs. 3, 13, 23, 36, 46, 55, 63

Thamnotettix cyperaceus Osborn, 1898: 245.

A large species, 5.0-6.8 mm. in length, with pointed vertex. General colour pale brownish-ochreous, with four black dashes along the anterior margin of the vertex and with three longitudinal brownish or reddish bands on the vertex, pronotum, and scutellum, the lateral bands broader than the median. These bands are distinctive and serve to separate the species from, for example, forms of *straminea* and *ciliata*, which it sometimes resembles in the seventh sternum of the female. The form of the aedoeagus distinguishes the species from these and from other species with which it might sometimes be confused.

There is some variation in general colour, from more pale to more dark, and in size. The longitudinal bands vary in colour and in distinctness; occasionally they are hardly visible. The seventh sternum of the female varies in shape and colour; often it is almost entirely dark except at the antero-lateral corners.

Paratypes were examined.

This species appears to be rather local in its distribution. Specimens from the following localities were examined. UNITED STATES:—Minnesota: Itasca Park and Two Harbours; Ohio: Ames; Wisconsin: Barberton, Brule, Madison, Muscego, St. Croix Fl., and Sullivan.

4. *Cicadula ciliata* (Osb.)

Figs. 4, 5, 14, 24, 25, 37, 47, 56, 64

Thammotettix ciliata Osborn, 1898: 284.

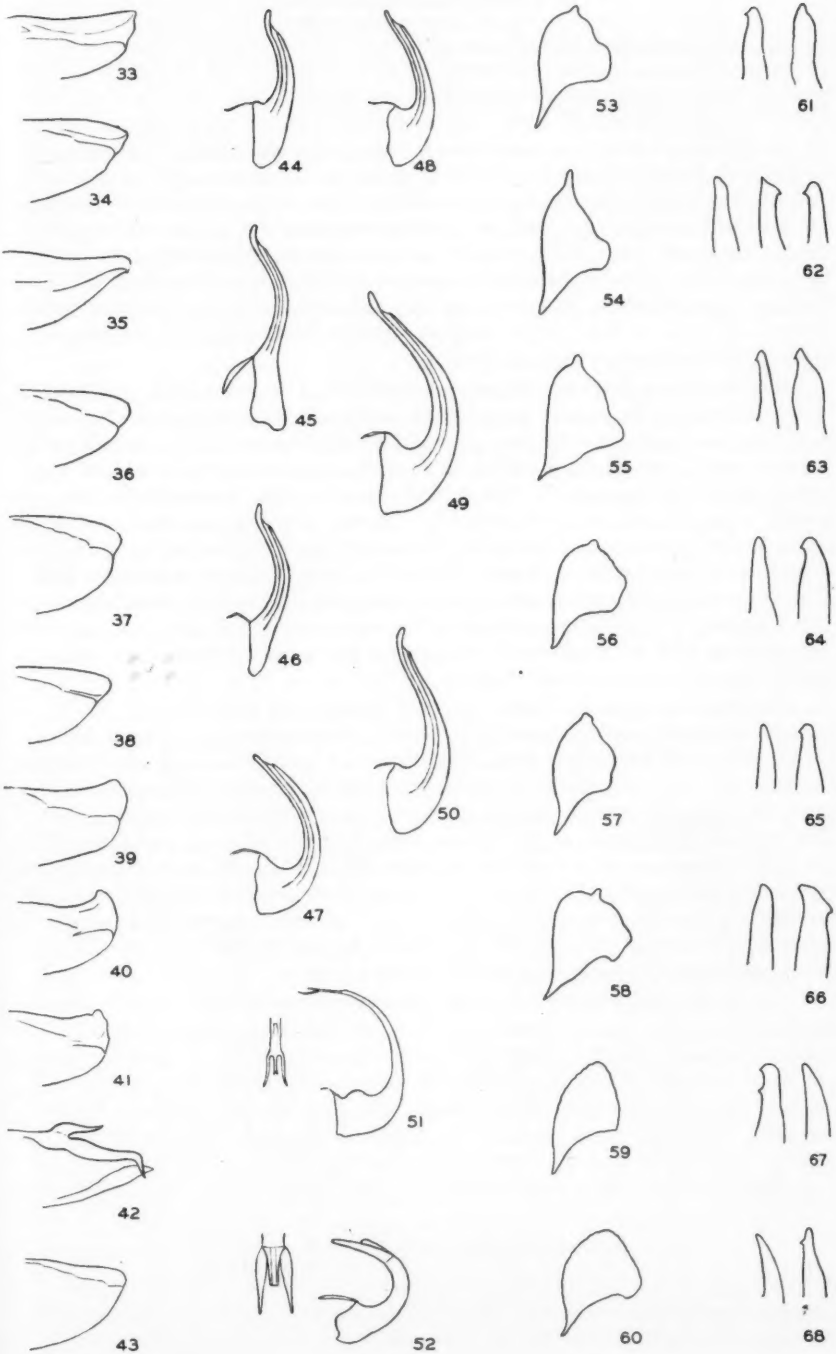
A species of moderate size, 4.8-5.5 mm. in length. General colour greenish-yellow, with four black spots at the anterior margin of the vertex, a black spot behind each ocellus, and a median pair of spots or lines on the disc of the vertex. The female may sometimes be confused with that of *straminea* but the striae of the seventh sternum are less prominent, the prominence from which they radiate is less distinct, and, in specimens in which that sternum is partly pale, the dark areas tend to be brown instead of black. Moreover, in *straminea* the disc of the vertex is usually without dark spots and the general size tends to be larger. On the basis of characters of the male genitalia, as well as of external characters, *ciliata* resembles *intermedia*, but in *ciliata* the aedoeagus is longer and more distinctly curved and often is slightly, but distinctly, thickened dorsal to the duct at about two-thirds the length of the shaft, the posterior ventral margin of the pygofer is distinctly bluntly angled, and the apex of the style is stout.

This is a variable species. The general colour varies from pale greenish-yellow to orange-yellowish or tawny. Frequently the frons is marked into black or brownish at either side of the mid line and the facial sutures are marked with blackish. The spot behind each ocellus is sometimes large and rounded, sometimes absent. The median marks on the vertex sometimes are two small spots near the anterior margin, and sometimes are absent. The seventh sternum of the female is usually brown or blackish on and between the striated areas but is often largely or wholly black. The striae vary somewhat in length, size, and number. There is some variation in the general shape of the sternum, sometimes as a result of breaking of a thin flange along the posterior margin. There is minor variation in shapes of parts of the male genitalia, notably in the length and degree of curvature of the aedoeagus.

Co-types were examined.

This is a widely distributed species with a transcontinental range. Specimens from the following localities were examined. ALASKA:— Anchorage, Katmai, and M.P. 89 and 96 on Steese Highway. CANADA:— Alberta: Black-foot Hills and Waterton Lakes; British Columbia: Penticton and Summerland; Manitoba: Brandon; Northwest Territories: Reindeer Depot at Mackenzie Delta; Saskatchewan: Rutland, Saskatoon, and Swift Current. UNITED STATES:—Arizona: Kaibab; California: Bishop, Doyle, Lake Tahoe, Sequoia National Park, and Yosemite Valley; Colorado: Dutch Geo., Fort Collins, North Peak, and Pingree Park; Idaho: Kataldo; Iowa: Ames; Kansas: Cherokee Co. and Douglas Co.; Montana: Drummond, Grantvale, and Ravalli Co.; North Dakota: Tokio; Oregon: Bend and Mondoc Point; Utah: Brigham, Echo, Lambs Canyon, Layton, Provo, Richfield, Salt Lake, and Strawberry Valley; Washington: Kalama, Quinault, and Republic; Wisconsin: Brule, Green Bay, Madison, and Osceola.

Figs. 33-68, male genitalia of *Cicadula spp.* 33-43, apical region of pygofer of: 33, 34, *C. smithi* (Van D.); 35, *C. melanogaster* (Prov.); 36, *C. cyperacea* (Osb.); 37, *C. ciliata* (Osb.); 38, *C. intermedia* (Boh.); 39, 40, 41, *C. straminea* (Sand. & DeL.); 42, *C. quinquenotata* (Boh.); 43, *C. longiseta* (Van D.).
44-52, aedoeagus, lateral view, of: 44, *C. smithi;* 45, *C. melanogaster;* 46, *C. cyperacea;* 47, *C. ciliata;* 48, *C. intermedia;* 49, 50, *C. straminea;* 51, *C. quinquenotata;* 52, *C. longiseta.*
53-60, ventral views of plates of: 53, *C. smithi;* 54, *C. melanogaster;* 55, *C. cyperacea;* 56, *C. ciliata;* 57, *C. intermedia;* 58, *C. straminea;* 59, *C. quinquenotata;* 60, *C. longiseta.*
61-68, apices of styles, from different viewpoints, of: 61, *C. smithi;* 62, *C. melanogaster;* 63, *C. cyperacea;* 64, *C. ciliata;* 65, *C. intermedia;* 66, *C. straminea;* 67, *C. quinquenotata;* 68, *C. longiseta.*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5. *Cicadula intermedia* (Boh.)

Figs. 6, 15, 26, 38, 48, 57, 65

Thamnotettix intermedia Boheman, 1845: 40.
Limotettix lunulifrons Sahlberg, 1871: 236.
Cyperana eruca DeLong, 1937: 231. New synonymy.
Cyperana montula DeLong, 1937: 232. New synonymy.

A species of moderate size, 4.6-5.8 mm. in length. General colour yellow tinged with greenish, with four black spots on the anterior margin of the vertex, a black spot behind each ocellus, and usually a pair of spots or lines in middle of the disc of the vertex. On a basis of external characters the species often resembles closely forms of *ciliata* and *quinquenotata*, but can be distinguished by genitalic characters. The form of the seventh sternum of the male is distinctive. The male genitalia resemble those of *ciliata*, but the aedoeagus is shorter and less sharply curved, the apex of the style is smaller, and the apical region of the pygofer is more distinctly tapering than in *ciliata*.

There is a considerable degree of variation. The four black spots on the vertex margin are frequently more or less confluent, though they rarely form an even band as in *smithi*. The face is often heavily marked with blackish on the frons at either side of the mid line and on the sutures but is sometimes almost wholly pale. The spot on the vertex behind each ocellus is frequently large and rounded but is occasionally absent. The paired markings on the disc of the vertex usually occur as two blackish or brownish parallel lines but are frequently reduced to a pair of small spots near the anterior margin and are sometimes absent. The pronotum is sometimes marked with brownish and the scutellum with black. The forewing is sometimes suffused with brown or fuscous between the veins. The anterior half of the seventh sternum of the female is frequently pale, but usually that sternum is wholly black.

The species found in North America agrees with specimens of *intermedia* from Finland and with figures and description of that species given by Kontkanen (1947). Ossiannilsson (1948) listed *lunulifrons* as a junior synonym of *intermedia*. Examination of types, which are males, of *eruca* and *montula* showed that they agree in characters of the male genitalia with each other and with *intermedia*. The original descriptions of the female seventh sterna of *eruca* and *montula* do not agree with that of *intermedia;* perhaps different species were mixed in the type series. The original description of the seventh sternum of *montula* could apply to *ciliata*, a species that occurs with *montula* and that resembles it closely in external characters. The original description of the seventh sternum of *eruca* could hardly apply to any species other than *longiseta*.

This species has a Boreal Holarctic distribution. Specimens from the following localities were examined. ALASKA:—M.P. 89 and 96 on Steese Highway and Valdez. CANADA:—Alberta: Banff and Cameron Lake; British Columbia: Stanley and Summerland; Manitoba: Churchill; Northwest Territories: Yellowknife; Quebec: Bradore Bay and Fort Chimo. FINLAND:—Leiska. UNITED STATES:—Colorado: Cameron's Pass, Dutch Geo., Pingree Park, and Utah; Montana: Anaconda; Oregon: Odell Lake; Utah: Lamb's Canyon, Sallina, and White Pine Lake in Logan's Canyon; Wyoming: Grand Teton National Park and Yellowstone Park.

6. *Cicadula straminea* (Sand. & DeL.)

Figs. 7, 8, 16-18, 27-30, 39-41, 49, 50, 58, 56

Thamnotettix stramineus Sanders and DeLong, 1917: 90.
Cyperana smithi pollicarius Ball, 1936: 193. New synonymy.
Cyperana wanakena Ball, 1936: 194. New synonymy.

Cyperana stylata DeLong, 1937: 230. New synonymy.
Cyperana gesa Delong, 1937: 231. New synonymy.
Cicadula intermedia Wagner, 1939: 186 (nec Boheman, 1845: 40). New synonymy.
Cicadula ossiannilssoni Kontkanen, 1947: 171. New synonymy.

A large species, 5.0-6.8 mm. in length. General colour yellow or tawny, with four black spots at the anterior margin of the vertex. In size and general colour this species often resembles *cyperacea*, which, however, can be distinguished by the reddish or brownish bands on the dorsal surface of the body and by the male genitalia. The seventh sternum of the female sometimes resembles that of *ciliata*, but the grooves are deeper than in *ciliata* and the ridges are more prominent and radiate from a more distinctly raised protruberance. Moreover, *ciliata* is a smaller species and is usually greenish-yellow in general colour. In the male, the long, curved, tapering aedoeagus, the expanded apical region of the pygofer, and the stout, bluntly-pointed style are distinctive.

This is a variable species. There is some variation in shape of the vertex and in size. The general colour varies from pale yellow to orange-tawny or yellow with a greenish tinge. The four black spots on the vertex margin are sometimes reduced to short, linear dashes, particularly in yellow specimens, but are sometimes enlarged and are sometimes partly or wholly confluent. In dark specimens there may be black or dark-brown markings on the frons on both sides of the mid line and the facial sutures may be marked with black. Occasionally there is a small black spot on the vertex behind each ocellus, and occasionally there is a pair of small black parallel lines on the disc of the vertex. Occasionally the forewings are more or less suffused with brownish or fuscous between the veins, especially in specimens from northern localities. The colour of the seventh sternum of the female varies from black on and between the striated areas only, to all black, and the ridges and grooves vary somewhat in length, depth, and number. There is some variation in the general shape of the sternum, due in part to whether or not the thin flange along the posterior margin is broken off. There is minor variation in the shapes of parts of the male genitalia, for example, in the form of the basal part of the aedoeagus.

Type material of *straminea*, *pollicarius*, *wanakena*, *stylata*, and *gesa*, and specimens of *ossiannilssoni* named by Kontkanen were examined, and it was concluded that these are all forms of the one species. Kontkanen (1949) showed that *intermedia* Wagner (nec Boh.) is the same as *ossiannilssoni*. The typical *straminea* is a large, yellow form with the black markings of the vertex margin reduced (Fig. 16) and the female seventh sternum yellow except on and between the striated areas (Figs. 27, 28). Examination of the genitalia of the male paratype of *pollicarius* showed that it was of *straminea*, and not a variety of *smithi* as described by Ball (1936). Presumably Ball treated it as a variety of *smithi* because the black markings of the vertex margin are confluent (Fig. 18). The name *wanakena* was given to a form that has the female seventh sternum black and heavily sculptured and with the thin posterior margin missing (Fig. 30). The names *stylata* and *gesa* were given to forms that tend to be smaller than *straminea* and brownish-yellow or greenish-yellow in general colour. According to the original descriptions, they differ from each other in minor characters of the male genitalia. These differences are well within the range of variation within the species. Most of the forms that have been named are not very distinctive, and they all intergrade.

The species has a Boreal Holarctic distribution. Specimens from the following localities were examined. ALASKA:—Anchorage, Birchill at Fairbanks, Matanuska, Palmer, 30 miles N.-E. of Anchorage, and M.P. 49 and 96 on Steese Highway.

CANADA:—Alberta: Banff; British Columbia: Chilcotin, Chimney Creek, Goldstream, Quesnel, Soda Creek, and Summerland; Manitoba: Aweme, Birch R., Brandon, Churchill, Cowan, Keld, and Shoal Lake; New Brunswick: Sun Co.; Northwest Territories: Yellowknife; Saskatchewan: Allan, Buchanan, Pelly, Pike Lake, Rutland, Triangle Flags, and Saskatoon; Yukon Territory: M.P. 1221 on Alcan Highway. FINLAND:—Leiska. UNITED STATES:—California: Bishop; Colorado: Northgate, Pingree Park, and Rocky Mountain National Park; Maine: Bar Harbour, Freyburg, and Naples; Michigan: Cheboygan Co.; Montana: Anaconda, Bennett, and Drummond; Nevada: Ely; New York: Canton and Cranberry Lake; Oregon: North Powder; Utah: Bountiful, Laketown, Logan Co., Trout Creek, Vernal, and Richfield; Washington: Hoquiam and Quinault; Wisconsin: Amery, Brule, Ladysmith, Marshfield, Asceola, and St. Croix Fl.; Wyoming: Evanston.

7. *Cicadula quinquenotata* (Boh.)

Figs. 9, 19, 31, 42, 51, 59, 67

Thammotettix quinquenotata Boheman, 1847: 38.
Limotettix nigricornis Sahlberg, 1871: 232.
Thammotettix decipiens Provancher (?), 1890: 284, et auctt. New synonymy.
Limotettix aurantipes Edwards, 1894: 103. New synonymy.
Limotettix persimilis Edwards, 1920: 57. New synonymy.

A species of moderate size, 4.6-5.5 mm. in length. General colour yellowish-green, with two black spots on the anterior margin of the vertex and a black spot behind each ocellus. A distinctive feature is the usual occurrence of only two spots on the vertex margin, instead of four as in other species. The forms of the seventh sternum of the female and of the aedoeagus, style, and pygofer of the male are distinctive.

There is some variation. The general colour varies from more yellowish to more greenish. Frequently the forewings are more or less suffused or streaked with brownish or fuscous between the veins, especially in specimens from northern areas or high altitudes. Frequently there are dark markings on the frons on both sides of the mid line and the facial sutures are marked with blackish. The black spots on the vertex margin vary in size; sometimes an outer pair of spots is indicated. The black spot behind each ocellus sometimes is very large and sometimes is absent or only feebly indicated. Rarely there are indications of median dark markings on the vertex and of brownish bands on the pronotum. In dark specimens the scutellum is sometimes marked with black. The female seventh sternum is often wholly black and is sometimes largely pale. There is minor variation in the length and degree of curvature of the aedoeagus and in relative length of its apical processes, as well as in other structures of the male genitalia.

This is the species that American authors have referred to as *decipiens*. The holotype of *decipiens*, which is in the Quebec Provincial Museum, was not available for study. It was examined by Van Duzee (1912), who did not indicate definitely whether or not it is of *decipiens* auctt. The American species agrees with *quinquenotata*, of which specimens of both sexes were examined and of which the male genitalia were figured by Wagner (1939). Specimens named by Edwards of both sexes of *persimilis* (co-types) and *aurantipes* were examined and no significant differences between them, or between them and *quinquenotata*, could be found; the genitalia of the three are identical, and identical with those of the American species. Ossiannilsson (1948) listed *nigricornis* as a junior

synonym of *quinquenotata*. The species is apparently not a synonym of *quadrinotata* (Fabricius, 1795, p. 43), to which it is very closely related on a basis of both external and genitalic characters.

The species has a Boreal Holarctic distribution. Specimens from the following localities were examined. ALASKA:—M.P. 154 on Glenn Highway. CANADA:—Alberta: Aspen Beach and Banff; British Columbia: Australian, Chilcotin, Kamloops, Merritt, Minnie Lake, Quesnel, Shawnigan, Summerland, and Vancouver; Manitoba: Swan R.; Northwest Territories: Yellowknife; Ontario: Arran Lake, Bradford, Merivale, and Timagami; Quebec: Bradore Bay; Saskatchewan: Attons Lake, Pelly, Pike Lake, and Waskesiu Lake. ENGLAND. UNITED STATES:—California: Lake Tahoe and San Jacinto Mts.; Colorado: Cameron's Pass, Fall R. Pass in Rocky Mountain National Park, Gunniston, Longs Peak Inn, Mancos, Muddy Pass, North Gate, Pike's Peak, Pingree Park, Walden, and Ward; Maine: Bar Harbour, Bath, and Dixiefield; Michigan: Cedar R. and Gobebic; Montana: Haugan and Missoula; New Hampshire: Crawford Notch, Franconia, and Littleton; New York: Lake Placid; Oregon: Odell Lake; Utah: Fish Lake, Heber, Richfield, and Strawberry Valley; Washington: Republic; Wisconsin: Amery, Brule, and Gillette.

8. *Cicadula longiseta* (Van D.)

Figs. 10, 20, 32, 43, 52, 60, 68

Thamnotettix longiseta Van Duzee, 1892: 266.

A small species, 3.8-4.5 mm. in length, with rounded vertex. General colour greenish tinged with yellow, the forewings often darker, with four black spots on the anterior margin of the vertex. The forms of the aedoeagus and of the seventh sternum of the female are distinctive. The seventh sternum somewhat resembles that of *smithi*, but normally has a different colour pattern and lacks the striae of that species. Moreover, *smithi* has a black band on the vertex margin whereas *longiseta* has four black spots.

There is some variation in the general colour, from more greenish to more yellowish, and in size. The black spots at the vertex margin vary somewhat in size. Dark specimens often have black markings on the frons on both sides of the mid line, the facial sutures marked with black or dark brown, a small black spot on the vertex behind each ocellus, and the scutellum more or less heavily marked with blackish. The seventh sternum of the female sometimes is almost wholly dark except at the postero-lateral corners (as in the holotype) and sometimes is almost wholly pale.

This species is known only from areas in and west of the Cordilleras. Specimens from the following localities were examined. CANADA:—Alberta: Glenwood; British Columbia: Kamloops, Penticton, Shawnigan, and Vancouver. UNITED STATES:—Arizona: Williams, Williamson Valley, and Yarnell Heights; California: Chico, Dunsmuir, Grass Valley, Kernville, Lake Tahoe, Maine Prairie, San Jacinto Mts., Turlock, and Weed; Colorado: Fort Collins, Greeley, North Gate, Palmer Lake, Peyton, Pingree Park, Rest Canyon, and Walden; Idaho: Tamarack; Montana: Anaconda; Nevada: Carson City and Steamboat; Oregon: North Powder; Utah: Pinto, St. John, and Woods Cross; Washington: Cheney, Pullman, Republic, and Ritzville; Wyoming: Yellowstone Park.

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A New Type of Coprometer for Laboratory and Field Use[1]

By G. W. Green and W. R. Henson[2]

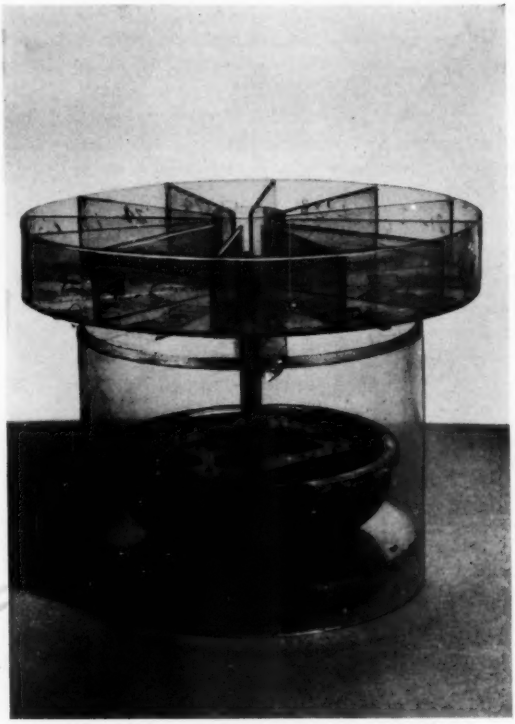

Fig. 1. A clock-driven coprometer

It is often desirable to establish the relationship between the amount of feeding of an insect and the prevailing meteorological conditions. With colonial insects, especially, it is difficult to determine visually whether members of a colony are feeding heavily, moderately, or lightly. If periodic measurements of frass drop are made, more reliable information may be obtained, for such measurements have proved to be reliable indicators of the intensity of feeding (Gornitz (1933); Monro (1935; Morris (1949), and Taranukha (1937)).

Coprometers are used to collect the frass ejected by insects through definite intervals of time. They provide an automatic, mechanical means of making the frass collections while the observer is employed elsewhere. In the field, their use is limited to defoliators which do not change their feeding sites too rapidly. In the laboratory, they may be adapted to almost any insect from which the frass has a free fall after ejection. The most commonly used coprometers depend on the collection of the frass in a funnel that guides it to a rotating, clock-driven disc either covered with an adhesive to which the frass sticks, or divided into 12 collecting bins, each of which takes one hour to pass the funnel tip (Fig. 1).

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[2]Forest Insect Laboratory, Sault Ste. Marie, Ontario.

Several difficulties arise with the use of such coprometers. If an adhesive is used on the collecting disc, only counts of frass pellets can be made, and any correlation between volume or weight of frass ejected and the prevailing conditions is impossible. If the disc is divided by septa, an error which is proportional to the diameter of the funnel tip aperture is introduced, since, on the hour, some pellets will fall into the previous hour's collection and some into the next. Furthermore, these types of coprometers are usually driven directly by clock mechanisms, and the load to which such mechanisms may be subjected is limited, and any undue strain on them can lead to timing errors. With these points in mind, a new type of coprometer was designed which has proven to be superior to the foregoing types in the following details:

1. No undue strain is placed upon the timing mechanism.
2. The collecting disc may be made smaller than in the other types without impairing the accuracy of the apparatus.
3. The frass is collected in deep wells which eliminate the possibility of wind removing part of the collection or the use of an adhesive for retaining the frass.
4. The aperture of the funnel tip may be made much larger than in either of the foregoing types without introducing a proportional error into the hourly frass collections. In the field, this point is quite important since needles and staminate flowers from coniferous trees often fall into the collecting funnel and hinder delivery of the frass to the coprometer if the tip aperture is small.
5. The shift from one collecting bin to the next is rapid, approximately five seconds, which introduces a timing error of only one minute in 12 hours' frass collection.

The unit, complete except for the collecting funnel, is shown in Fig. 2. The escapement mechanism is shown in Fig. 3. In operation, a contact is made every hour between a brush attached to the minute shaft of the timing clock and a contact point firmly mounted upon the wooden platform which supports the clock. As the circuit is closed, the current from five series-connected dry cells activates two electromagnets, which release the retaining-post roller from one of the teeth on the inner ring of the escapement disc and bring it into position to oppose the adjacent tooth in the outer ring as the escapement disc is rotated by the drive spring. This allows the collecting disc to rotate 1/24 of a revolution. As the contact is broken, and the magnets are de-energized, a retainer spring pulls the retaining-post roller back so that it again opposes the inner ring of teeth on the escapement disc. By this movement, the collecting disc is rotated an additional 1/24 of a revolution and a new collecting bin is brought into position beneath the funnel tip.

The escapement mechanism is housed in a "Lucite" cylinder which is fastened to the lid of the plywood box containing the timing clock and the dry cells. This mechanism is easily taken down (Fig. 4) by removing the pins which support the components within the cylinder. Since the cylinder is transparent, the mechanism can be seen at all times, and any disorder can be detected quickly.

In the labratory, any type of funnel which is sufficiently large to accommodate the food of the insects may be used to guide the frass to the coprometer. In the field, circular, cellulose acetate funnels with steeply sloping sides have been employed. These should be made large enough so that the branch upon which the insects are feeding can move freely in normal winds without letting frass fall outside the funnel. The funnel may be mounted high or low on the tree if a plastic tube is used to guide the frass from the funnel tip to the coprometer on

Fig. 2. The new type of coprometer, complete except for the collecting funnel.

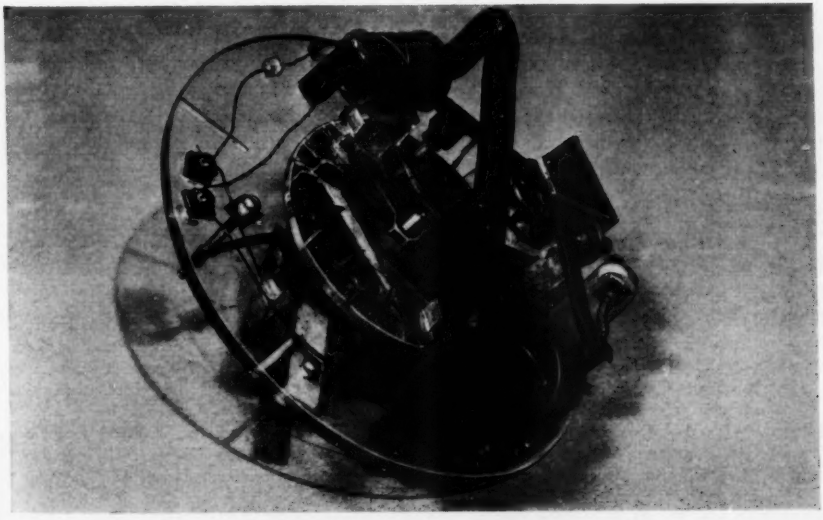

Fig. 3. The escapement mechanism viewed from its underside.

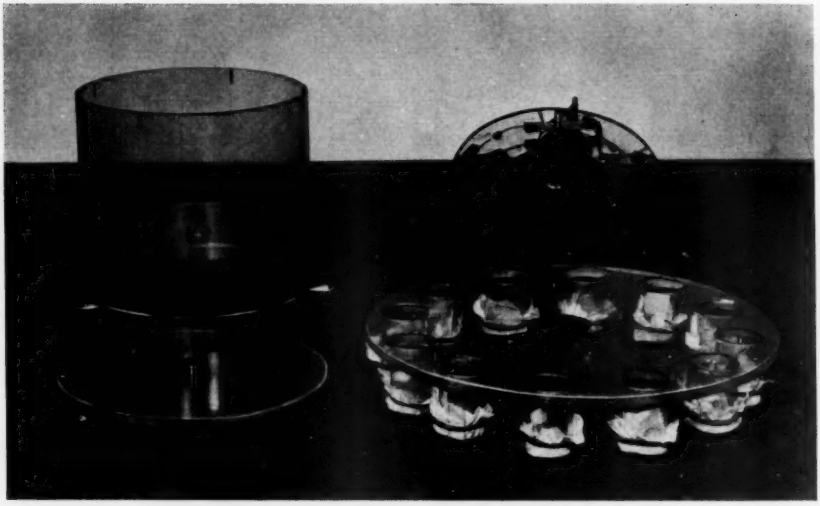

Fig. 4. The escapement mechanism, housing, and collecting disc taken down to show ease of access.

the ground. In field use, dew formation on the funnel sides and on the inner wall of the tube causes frass to stick to these surfaces. This may be counteracted by winding resistance wire about the outside of these units, and applying enough current to maintain their surface temperatures slightly above the temperature of the air.

The apparatus has given excellent service both in the labratory and in the field. Dry cells should last through at least one summer of continual operation, and the only maintenance required, other than changing the collecting disc and winding the clock, is weekly cleaning of the contact points. The coprometer is quite waterproof and has operated continuously through heavy rainstorms. During heavy rain, any frass that falls is usually washed down through the funnel and into the collecting bins. However, continuous, light rain causes frass to stick to the funnel sides and renders invalid any frass collections made through such periods. This error has not been overcome and limits the range of weather conditions under which hourly frass collections can be made.

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Book Review

***The Injurious Insects of the British Commonwealth with a Section on The Control of Weeds by Insects*, by J. W. Evans. 242 pp. Commonwealth Institute of Entomology, 41 Queen's Gate, London S.W.7, Eng. 1952. Price 30 shillings.**

"The purpose of this work is to provide a source of reference and of concise information on most of the injurious insects of the British Commonwealth, with the exception of the British Isles, India and Pakistan." By design insects of a cosmopolitan nature have largely been omitted; reliance has been primarily upon information published in the *Review of Applied Entomology* (1913-1950); and only an uncritical compilation has been attempted. The result, as judged by references to Canada, is a record that is not only incomplete but out of date and of such varying quality as to be unreliable as a primary reference work.

The material is presented in five parts, European terminology being used in scientific names. Part 1 (pp. 1-37) purports to outline for each country in the Commonwealth the environmental conditions, principal crops, important insect pests of plants, and especially the principal insects and ticks of medical and veterinary importance. In general, the descriptions of regions, crops, etc., are too superficial to be of value. Thirty-eight species and groups of species are listed under "Principal Insect Pests of Plants" in Canada. Included are *Anabrus simplex* and *Popillia japonica*, which are actually very minor; *Nygmia phaeorrhoea*, which has been of no importance for over 30 years; and *Lepidiota* spp. which never have been recorded in Canada. Excluded are such important pests as *Euxoa* spp., *Ctenicera aeripennis*, *Myzus persicae*, *Adelges piceae*, and *Metatetranychus ulmi* – although notes are given on some of these in later sections. A useful summary of the tsetse-fly problem in Africa is given as a special feature of this chapter.

Part 2 (pp. 38-58) lists the important pest species of various crops. Here the same lack of critical treatment is evident: *Phyllophaga anxia* is properly included under "General Plant Feeders" but *Ctenicera aeripennis*, also omnivorous, is listed under "Cereals" only and *Pyrausta nubilalis* is given under both "Cereals" and "Maize" although rarely troublesome in the former in Canada; and under "Blueberry" reference is omitted to *Rhagoletis pomonella*, the most injurious species, and under "Tobacco" to *Limonius agonus*, *Phlegethontius quinquemaculata*, and *Myzus persicae*, all of primary importance in Canada.

Part 3 (pp. 59-203) is a discussion by orders, families, genera, and species of some 1,100 species of insects and mites injurious to plants. In his introductory remarks, the author warns, "The omission of the name of a country from a list of countries from which an insect has been reported does not necessarily indicate its absence from that region, but that its occurrence, if reported, has been overlooked or disregarded." Thus the reader is again in doubt as to the completeness and reliability of the material presented. This general criticism may be supported by specific reference to departures from fact or informed current opinion as, for example, *Agrilus anxius* is no longer believed to be "the principal contributing factor inducing dieback of birch in Canada"; *Leptinotarsa decemlineata* does not occur "in every province in Canada", not being recorded from Newfoundland; *Popillia japonica* can hardly be listed as "widely distributed in North America" since in Canada it is known from only restricted southern areas of some of the Eastern Provinces; no reference is made under *Cephus cinctus* to the development of resistant varieties of wheat; and the section on Elateridae is worthless, giving

an inadequate and misleading conception of the nature and scope of the wireworm problem in Canada. Neverthless, useful information is given for many species such as *Phyllophaga anxia* and *Diprion hercyniae* in Canada; *Locusta migratoria migratorioides* in Africa; *Plutella maculipennis*, *Heliothis armigera*, and *Carpocapsa pomonella* in several Commonwealth countries.

Part 4 (pp. 204-210) is "Weed Control by Insects" and covers 14 weed species or groups of species. The most extensive coverage is given to St. John's-wort, prickly pears, gorse, and *Lantana camara.*

Part 5 (pp. 211-221), "Special Problems", includes plant quarantine, insect control, and research needs. Although falling outside the title and purpose of the book, most of the sections raise important points and make interesting reading.

The index (pp. 223-242) is complete with "synonyms, alternative names and misidentifications."

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